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APRIL 1981

# MICRO<sup>TM</sup>

## THE 6502 JOURNAL



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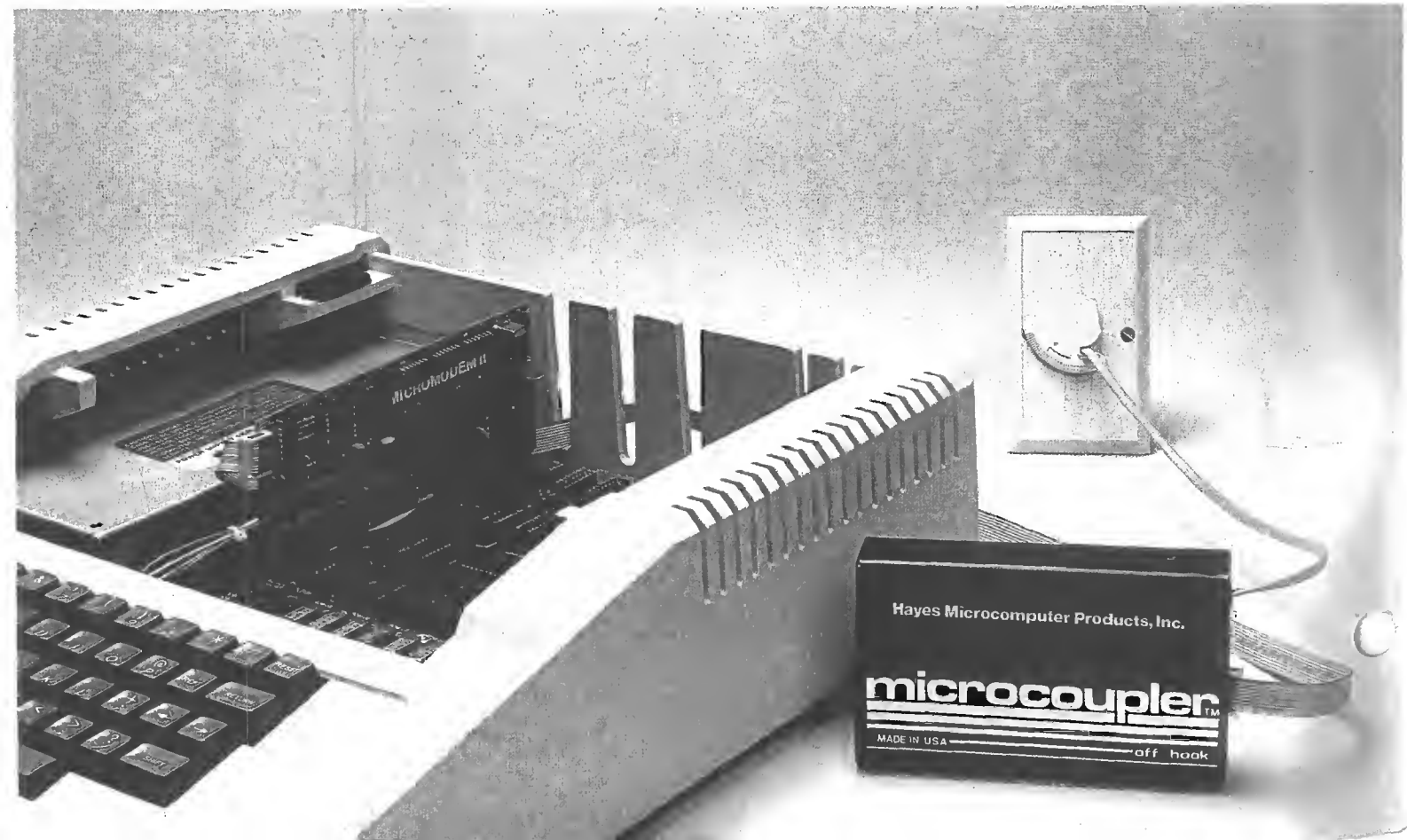
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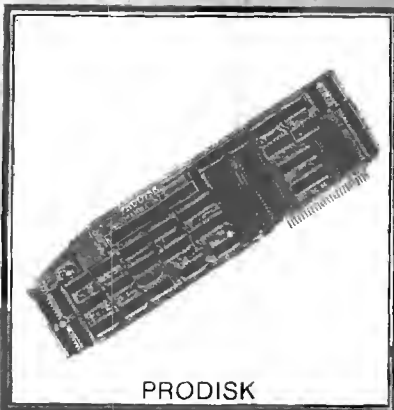
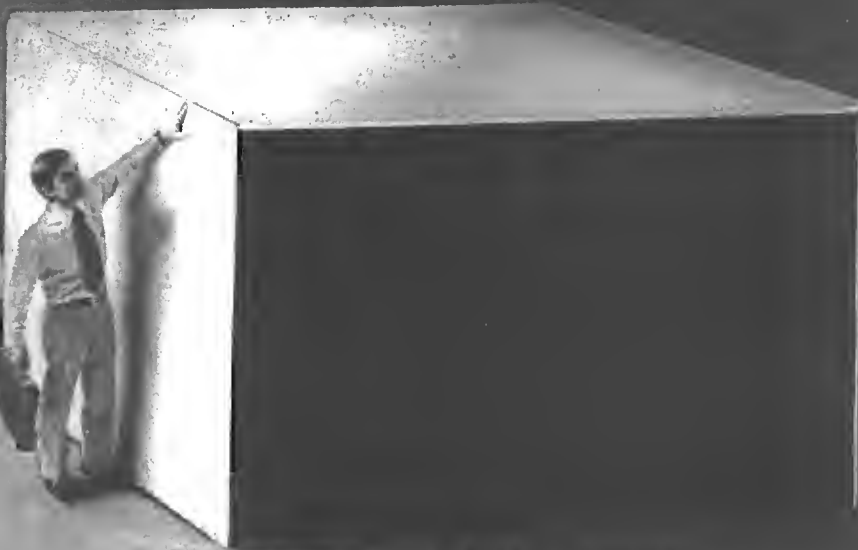
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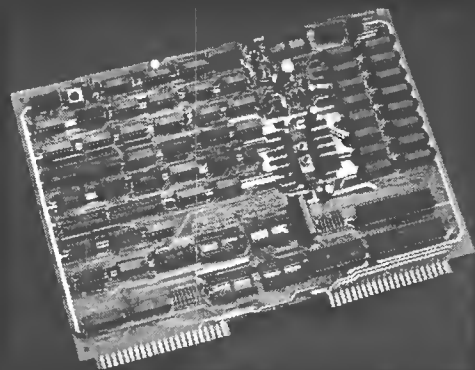


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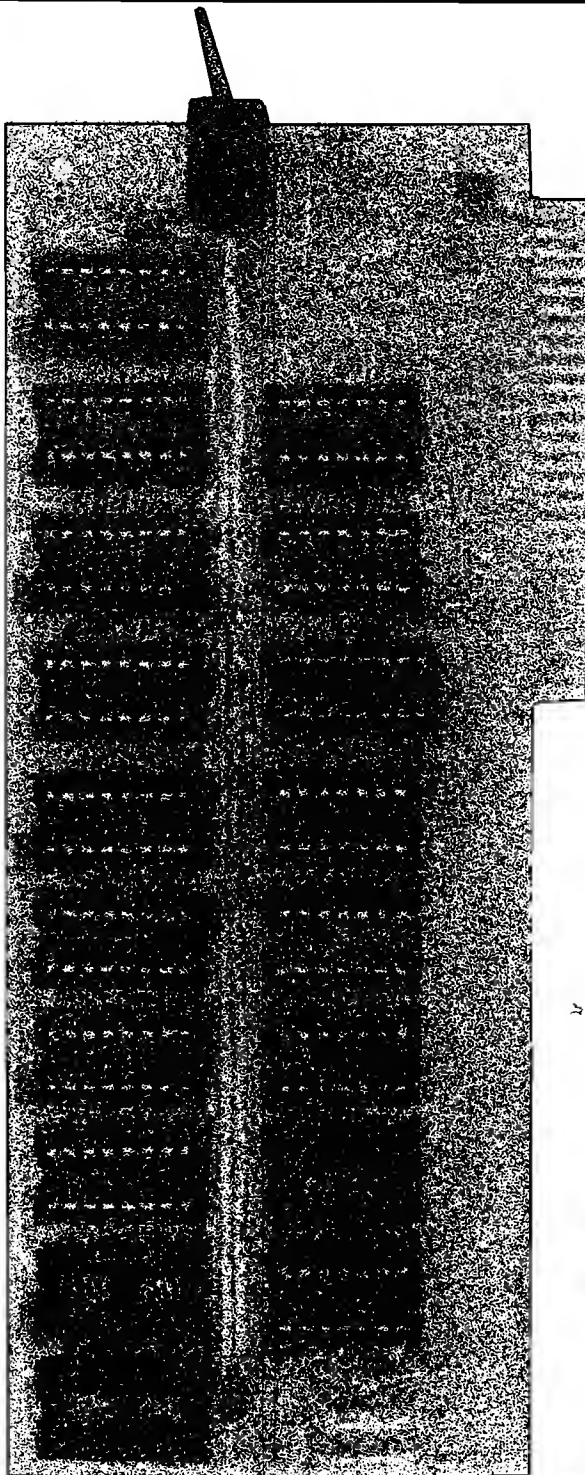
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# MICRO

## Editorial

### Staff and Stuff

Most readers probably never read the staff listing on the Table of Contents page, but those who do will note that since the beginning of this volume, [June 1980] we have added an associate publisher, special projects editor, art director, advertising manager, three micro specialists and a typesetter. This improved staffing permits MICRO to deliver a better product each month and to undertake a number of other projects as well.

One major undertaking is book publishing. A series of Apple books is under way, with the first, *MICRO/Apple, Volume 1*, to be released April 1. This collection of Apple articles from past issues of MICRO is intended for the beginner-to-intermediate Apple user. All of the material has been re-edited, re-typeset and many articles have been updated by the original authors and/or the MICRO staff. All programs have been re-entered, listed and tested. They are provided on a diskette which is an integral part of the book. The 224-page book is wire-bound

and lies flat when open to make it easy to use.

Other books in the *MICRO/Apple* series will include reprints, original articles, new reference works, and more. This will permit us to present various types of material which do not work well in a magazine format: long articles or listings, good articles of limited scope, and so forth.

We are looking for additional material for other major microcomputers to support similar books for the PET, OSI, AIM, SYM, KIM and Atari. If you have material which you may not have submitted because you felt that it was not suited to a magazine presentation, please consider it for one of the books. If you have a complete manuscript for a 6502-based book, or even just the idea for one, please contact us. We may be interested in publishing it and distributing it to the 6502 world through our dealer network.

### An Apple Solution

The February editorial addressed the problem of "Too Many Apples"—more Apple articles on a regular basis than we can incorporate in MICRO without overwhelming the other 6502-based microcomputers. The reader response may be summarized as:

no one favored "no change" or "print the extra Apple material in book form";

only a few wanted to "print the best material without regard to micro-computer";

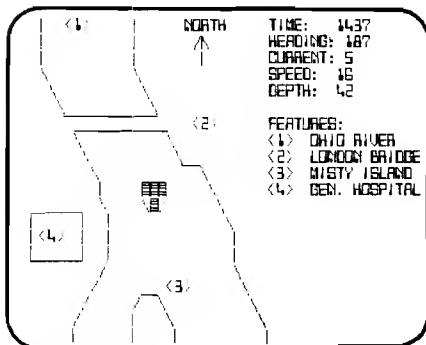
more wanted to "publish an Apple supplement or quarterly" or "publish a monthly Apple magazine"; most chose to "increase the size of MICRO to accommodate additional Apple material without reducing the coverage of the other micros."

This reader feedback and our in-house staff discussions agree, and the decision has been made to expand MICRO. Starting with the June 1981 issue, there will be "extra" pages devoted to Apple articles and advertisements. The number of pages will be determined partially by the extra advertising required to cover the additional production, printing and postage costs—without requiring an increase in either the single copy or subscription price. There will be at least 16 extra pages, and possibly 32 pages. This expansion will permit us to provide timely Apple coverage while maintaining our policy of serving the entire 6502 community.

*Robert M. Tripp*

Robert M. Tripp  
Editor/Publisher

### About the Cover—



Screen display on this month's cover — from the human point of view.

(Cover photo by Michael Rakip)

### Cruising Down the River...

Imagine yourself cruising down the river on the Delta Queen. To navigate rivers you need maps and charts. Currently these are available as printed material, very detailed and very accurate. Accurate? Well, the chart was accurate when it was made, but how long ago was that? And what changes have occurred since then?

How about a computer displayable map—one that could be updated continuously by whatever authority has the charting responsibility, the U.S. Coast Guard or the U.S. Geodetic Survey? A diskette could be generated which contains the latest information along a particular route. It could provide whatever level of detail is required; from an overview as pictured on the cover, to the detail normally provided in navigational charts. As the position of the vessel is

entered into the computer, manually in a simple system or automatically in a more advanced one, the display could change to provide the current map information.

In addition to the pure mapping function, the computer could provide a wealth of other information. Time of day, current speed, vessel speed, direction, rate of fuel consumption, estimated time to destination or check point, and other operating parameters could be displayed. Automatic radio tracking equipment could provide accurate positioning information. Depth information in coastal waters could be continuously updated and modified as a function of tide tables. The possibilities for this type of microcomputer application are almost limitless.

But for now, I guess I'll just keep drifting.

# MICRO

## Letterbox

Dear Editor:

First, I don't know of any available printed material that has been as interesting and informative as "MICRO Magazine".

Many little problems related to programming have been removed due to the care and testing that is done, by writers, proofreaders, editors and by the production people. The quality is outstanding as witnessed by the brevity of your "Microbes" pages.

Now, the second part—I feel that I have received more value from this source than it has cost. Therefore, I offer this little tip for Apple II owners fortunate enough to have Disk II. Perhaps I am lazy, but my fingers get tired of constantly typing "catalog" following the end of a program. I know that many programs exist to change the disk command to cat or just plain 'C'. They are good, but why not insert these lines in place of "END" statement in the programs used frequently?

```
XX0 INPUT "WANT DISK  
CATALOG (Y/N) ?";A$  
XX1 TEXT:HOME  
XX2 IF A$ = "Y" THEN PRINT  
D$;"CATALOG"
```

Your program is still in memory should you choose to re-run it. Or with the catalog menu in front of you, a change to a different program is quite simple.

Another simple little tip is to type "VTAB < 1 THROUGH 20 >" to move the cursor up to the program desired, enter your command, and use the right arrow key to trace over the program listing, hit return, and your command is executed. Be sure that you don't leave any part of the program type or sector information before tracing over the program title. Those little left-overs produce nice error statements.

Thanks again for an excellent publication. I look forward to seeing it each month for it makes the Apple II more enjoyable for this retired telephone man who is pretty much housebound.

John A. Backman  
302 North 76th  
Seattle, WA 98103

Dear Editor:

I appreciated the letter by Robert V. Davis, MICRO, January 1981, but his letter didn't take full advantage of OSI's BASIC-in-ROM accuracy and he doesn't solve the absence of the PRINT USING command for anything but whole dollars.

That would be trouble if you're working in any accounting program where you need to keep track of pennies. The subroutine I am enclosing will print out amounts in dollars and cents from \$0.00 to \$167,772.15 with full accuracy and amounts close to one billion with 7+ decimal accuracy before going into scientific notation errors. Since Michigan income tax asks that you don't round off at one place, this program would keep you out of trouble with the taxman. Also by simply changing the value of H in line 20000 by a power of ten, and making the opposite change of T, you can set up for printing in the thousandth place or any other decimal place you wish with 7+ decimal accuracy. This routine will also increase the amount of decimals printed with any other BASIC computer.

```
50 INPUT "AMOUNT OF  
CASH";B: A = B  
60 PRINT "BALANCE";:GOSUB  
20000  
70 REM REST OF PROGRAM  
19999 PRINTING SUBROUTINE  
20000 H = 100:T = 1000:  
G = 0:C = A:IF A > T*9  
THEN G = T*INT(A/T):C =  
A - G + T  
20010 PLACE = INT(LOG  
(H)/LOG(10) + .5):IF A < 1  
THEN 20070  
20020 A$ = STR$(INT(H* C + .5)):  
AC$ = RIGHT$(A$,PL):  
B = LEN(A$)  
20030 A$ = LEFT$(A$,B-PL) +  
"." + AC$:IF G > 0 THEN  
A$ = STR$(G/T) + MID$(  
A$,3)  
20040 PRINT TAB(20-LEN(A$))"$  
";A$:RETURN  
20060 REM AMOUNTS LESS  
THAN 1  
20070 A$ = STR$(INT(A*H  
+ .5)/H):IF  
LEN(A$) < PL + 2 THEN  
A$ = A$ + "0":  
GOTO 20070  
20080 GOTO 20050
```

Dale Mayers  
2301 S. Washington  
Lansing, MI 48910

Dear Editor:

I'd like to share the following information in response to your Editorial in the January 1981 issue (MICRO Goes to School).

Our math department was given the job of learning how to operate the computers, then teach our students, then teach any interested non-math teachers. Granted, year #1 was trial and error. We spent many hours on our own time getting our act together.

Several members of the department formed a core group which learned how to program and joined area users groups, and then brought this information back to the rest of the department for general use. We subscribe to the leading magazines for help and greatly appreciate MICRO's help with the Club Circuit.

By using small ads, we have contacted and exchanged ideas, programs, and student booklets with teachers in several states. There is a vast network out there of independent math teachers which the computer will bring together.

This year, in our lab, we are more organized. Lab slots are assigned on a week-to-week basis and we have lab assignments sheets for the students, that they receive before they enter the lab. The sheets contain information as to what programs they should work on, what section of particular programs, what disks to use, which computers to be worked on, if the printer is to be used, etc. Thus, any computer center means preparation by the teachers involved if the center is to achieve its goals in the educational environment. And with the availability of data base programs, the department has its grades, orders, inventory, small supplies, etc., on disk.

Our computer center has taken a lot of effort, but it is well worth it. If any teacher or department requires more information, they may write to Apple Bit 'N Pieces Educators Group c/o our school.

Patrick J. Calebrese  
Math Dept. Chairman  
Millcreek Township School District  
Millcreek Middle School—J.S. Wilson  
900 West 54th Street  
Erie, PA 16509



# S-C Assembler Modifications

The usefulness of the S-C assembler for the Apple can be enhanced with the addition of a command to automatically generate line numbers for the programmer while he is entering the source code.

Ned W. Rhodes  
2001 No. Kenilworth St.  
Arlington, Virginia 22205

The S-C assembler is one of the many assemblers available for the Apple computer system. The original version of the S-C assembler was cassette-based and performed well for the user with a minimal system. Subsequent versions of the assembler have been disk-based. With the announcement of version 3.2, previous owners were invited to upgrade their assemblers for \$12.50. This I did, and along with my upgrade kit came information on how the S-C assembler could be modified to incorporate more features. In this article I will describe modifications to the S-C assembler that allow the S-C assembler to work with the auto-start ROM, automatically generate line numbers for source code entry, and allow the user to change the starting line number and increment for the auto-line numbering mode.

## Adding Back the Multiply Routine

In the auto-start ROM, Apple has incorporated some features that make line editing easier and allow the Apple to automatically boot itself when power is applied. In order to give us all of these features, they had to replace some old (and very useful) code in the F8 ROM with their new routines. One of the deleted routines happened to be the Integer multiply routine which is used by the S-C assembler. So, if you have the auto-start ROM, you must patch the assembler and add the multiply code in order to make the

## Listing 1

```

1000 *
1010 *
1020 *
1030 *
1040 *
1050 *
1060 *
1070 *
1080 *
1090 *
1100 *
1110 *
1120 *
1130 *
1140 *
1150 *
1160 *
1D21- 2C 7D 1D 1170 ANUM BIT FLAG      TEST AUTO-FLAG
1D24- 1D 27 1180 BPL EXIT      NOT TURNED ON
1D26- 4E 7D 1D 1190 LSR FLAG      CLEAR THE FLAG
1D29- E0 00 1200 CPX #0       IF NOT IN COLUMN 1
1D2B- D0 20 1210 BNE EXIT      THEN DON'T DO IT
1220 *
1230 *
1240 *
1250 *
1260 *
1270 *
1D2D- 20 5C 1D 1280 JSR CONV4      CONVERT LINE NUMBER
1290 *
1300 *
1310 *
1320 *
1330 *
1340 *
1D30- F8 1350 SED          SET DECIMAL MODE
1D31- 18 1360 CLC          CLEAR CARRY
1D32- AD 7A 1D 1370 LDA NUM+1      ADD LAST'S
1D35- 6D 7C 1D 1380 ADC INC+1
1D38- 8D 7A 1D 1390 STA NUM+1
1D3B- AD 79 1D 1400 LDA NUM        ADD MSR'S
1D3E- 6D 7B 1D 1410 ADC INC
1D41- 8D 79 1D 1420 STA NUM
1D44- DB 1430 CLD          SET BINARY MODE
1D45- A9 A0 1440 LDA #5A0      SEND A SPACE TOO
1D47- 20 72 1D 1450 JSR CHO
1D4A- 4C 0C FD 1460 JMP $FDOC     INPUT NEXT CHARACTER
1470 *
1480 *
1490 *
1500 *
1510 *
1520 *
1530 *
1540 *
1D4D- 20 1B FD 1550 EXIT JSR $FD1B    MONITOR KEYIN
1D50- C9 8E 1560 CMP #5RE    CONTROL-N??
1D52- D0 05 1570 BNE RTN      NO
1D54- A9 8D 1580 LDA #5BD    CHANGE TO CONTROL-M
1D56- 8D 7D 1D 1590 STA FLAG    SET FLAG
1D59- 4C 8B 13 1600 RTN JMP $13BB    RE-JOIN SCALL
1610 *
1620 *
1630 *
1640 *
1650 *
1660 *
1D5C- AD 79 1D 1670 LDA NUM        FIRST TWO DIGITS
1D5F- 20 65 1D 1680 JSR CONV2
1D62- AD 7A 1D 1690 LDA NUM+1      LAST TWO DIGITS
1700 *
1710 *
1720 *

```

assembler run properly. Bob Sander-Cederlof (the S-C assembler creator) included the patch along with my upgrade kit and I will repeat it here.

Before we can patch the assembler, we have to create some room for the patch. Bob suggested that we move the starting address of the symbol table up a page or two, and make all patches and modifications in this new space. The assembler resides in memory from \$1000 through \$1BFF, and the symbol table follows, starting at \$1C00. The moving of the symbol table is accomplished by changing location \$1010 in the assembler. Now, I suggest that we start the symbol table at \$1E00 so that we have plenty of room for the enhancements that are to be described later on. The step-by-step instructions for moving the symbol table are:

1. Load the assembler
2. Change contents of \$1010 to \$1E
3. Re-save the assembler using BSAVE ASMB,A,\$1000,L\$E00

Note that the older versions of the assembler may also be patched in this fashion, but that the address to be patched will not necessarily be the same. In that case, use the Monitor disassembler and examine memory on either side of address \$1010 until you find either a \$1C or \$1D, as that was the default-starting page number of the symbol table.

The multiple routine may now be added, starting at location \$1D00 using the monitor insert command.

\*1D00: A0 10 A5 50 4A 90 0C 18  
A2 FE B5 54 75 56 95 54

\*1D10: E8 D0 F7 A2 03 76 50 CA  
10 FB 88 D0 E5 60

And finally, we need to change the JSR instruction that points to the multiply routine to point to the relocated code for the multiply routine. You should find a JSR \$FB63 at location \$1122. The following will change the destination address to \$1D00.

\*1123: 00 1D

Now, the assembler may be saved as instructed in step 3 above. This modified version of the assembler will now work properly with the auto-start ROM.

### Automatic Line Numbers

The other little goodie that Bob included in my upgrade kit was a routine that allowed the assembler to automatically generate line numbers so

```

1730 *
1740 CONV2
1D65- 48 1750 PHA SAVE BYTE ON STACK
1D66- 4A 1760 LSR GET LEFT DIGIT
1D67- 4A 1770 LSR
1D68- 4A 1780 LSR
1D69- 4A 1790 LSR
1D6A- 20 70 1D 1800 JSR CONV1 CONVERT AND STORE IT
1D6D- 68 1810 PLA GET BYTE FROM STACK
1D6E- 29 0F 1820 AND #$0F ISOLATE SECOND DIGIT
1830 CONV1
1D70- 09 B0 1840 ORA #$B0 CONVERT TO ASCII
1D72- 9D 00 02 1850 CHO STA $200,X STORE IN INPUT BUFFER
1D75- E8 1860 INX INCREMENT BUFFER POINTER
1D76- 4C ED FD 1870 JMP $FDED PRINT THE CHARACTER
1880 *
1D79- 10 00 1890 NUM .HS 1000 INITIAL NUMBER
1D7B- 00 10 1900 INC .HS 0010 INCREMENT
1D7D- 00 1910 FLAG .HS 00
1920 .END

```

### SYMBOL TABLE

```

ANUM 1D21 EXIT 1D4D RTRN 1D59
CONV4 1D5C CONV2 1D65 CONV1 1D70
CHO 1D72 NUM 1D79 INC 1D7B
FLAG 1D7D

```

### Listing 2

```

1000 *
1010 *
1020 *
1030 *
1040 *
1050 *
1060 *
1070 * THIS ADDS THE AUTO COMMAND TO THE
1080 * S-C ASSEMBLER. THE AUTO COMMAND
1090 * ALLOWS YOU TO SET THE STARTING LINE
1100 * NUMBER AND THE INCREMENT FOR AUTOMATIC
1110 * LINE ENTRY.
1120 *
1130 * THE FORMAT OF THE COMMAND WILL BE:
1140 *
1150 * AUTO START,INC
1160 *
1170 *
1180 SPACE .EQ $20 SPACE
1190 LBUF .EQ $200 LINE BUFFER
1200 COMMA .EQ $2C COMMA
1210 WARM .EQ $1003 WARM START
1220 NUM .EQ $1D79 STARTING LINE NUMBER
1230 INC .EQ $1D7B INCREMENT
1240 .OR $1D7E AFTER THE AUTO LINE NUMBER GENERATOR
1250 *
1260 *
1270 *
1280 AUTO LDY #3 START AT FOURTH CHARACTER
1290 SLOP LDA LBUF,Y GET CHARACTER
1300 BEQ DONE ALL DONE--DO NOTHING
1310 CMP #SPACE IS IT A SPACE??
1320 BEQ GSPAC YES
1330 INY BUMP Y
1340 BNE SLOP IDLE UNTIL A SPACE
1350 *
1360 *
1370 * GOT A SPACE. IDLE UNTIL NO MORE SPACES
1380 *
1390 *
1400 GSPAC
1410 INY BUMP Y
1420 LDA LBUF,Y GET CHARACTER
1430 BEQ DONE WE ARE DONE
1440 CMP #SPACE IS IT A SPACE
1450 BEQ GSPAC LOOP UNTIL NO SPACE
1460 *
1470 *
1480 * COUNT THE NUMBER OF CHARACTERS
1490 * UNTIL THE "." AND SAVE THE POSITION
1500 * NUMBER OF THE LAST CHARACTER.
1510 *
1520 *
1530 LDX #00 GET A ZERO
1540 CLOP CMP #COMMA IS IT A COMMA??
1550 BEQ SAVIT YES
1560 INX BUMP COUNT
1570 INY BUMP CHARACTER SCAN
1580 LDA LBUF,Y GET NEXT CHARACTER
1590 BEQ SAVIT SAVE PARAMETERS
1600 BNE CLOP TRY AGAIN
1610 *
1620 *
1630 * WE GET HERE AND SAVE X AND Y FOR LATER

```

```

1640 *
1650 *
1660 SAV IT
1670 STX SCNT      SAVE COUNT
1680 STY EPOS      END POSITION + 1
1690 LDA LBUF,Y    GET CHARACTER AGAIN
1700 BEQ DSTRT     IF ZERO GO AWAY
1710 *
1720 *
1730 *      SCAN THE INCREMENT
1740 *
1750 *
1760 INY           NEXT CHARACTER
1770 LDY #00       ZERO COUNT
1780 LDA LBUF,Y   GET CHARACTER
1790 BEQ DINC      DONE WITH SCAN
1800 INX           RUMP COUNT
1810 INY           NEXT CHARACTER
1820 BNE ILOP      REPEAT TIL DONE
1830 *
1840 *
1850 *      CONVERT THE INCREMENT AND SAVE
1860 *
1870 *
1880 DINC TXA      SET CONDITION CODE
1890 BEQ DSTRT     IF ZERO DO START
1900 JSR GETNUM     CONVERT NUMBER
1910 LDA HOLD      GET MSB
1920 STA INC        SAVE
1930 LDA HOLD+1    GET LSB
1940 STA INC+1     SAVE
1950 *
1960 *
1970 *      DO THE START LINE NUMBER
1980 *
1990 *
2000 DSTRT
2010 LDY SCNT       GET COUNT
2020 BEQ DONE       IF ZERO -- IGNORE
2030 LDY EPOS       GET POSITION
2040 JSR GETNUM     CONVERT
2050 LDA HOLD      GET MSB
2060 STA NUM        SAVE
2070 LDA HOLD+1    GET LSB
2080 STA NUM+1     SAVE
2090 *
2100 *
2110 *      DONE OR ABORT
2120 *
2130 *
2140 DONE JMP WARM  WARM START
2150 *
2160 *
2170 *      GETNUM -- CONVERTS ASCII TO BCD
2180 *
2190 *
2200 GETNUM
2210 LDA #00       GET A ZERO
2220 STA HOLD      ZERO OUT
2230 STA HOLD+1    ZERO OUT
2240 JSR READ8     GET 8 BITS
2250 STA HOLD+1    SAVE BITS
2260 DEX           DECREMENT LOOP COUNT
2270 BEQ EXT       DONE
2280 JSR READ8     GET 8 BITS
2290 JSR SHIFT     SHIFT LEFT 4
2300 *
2310 CLC           CLEAR CARRY
2320 ADC HOLD+1    PUT IN BITS
2330 STA HOLD+1    SAVE BACK
2340 DEX           DECREMENT LOOP COUNT
2350 BEQ EXT       DONE
2360 JSR READ8     GET 8 BITS
2370 STA HOLD      SAVE BITS
2380 DEX           DECREMENT LOOP COUNT
2390 BEQ EXT       DONE
2400 JSR READ8     GET BITS
2410 JSR SHIFT     SHIFT LEFT 4
2420 CLC           CLEAR CARRY
2430 ADC HOLD      ADD IN BITS
2440 STA HOLD      SAVE BACK
2450 EXT RTS      RETURN
2460 *
2470 *
2480 *      READ8 -- READ 8 BITS FROM LINE BUFFER
2490 *
2500 *
2510 READ8
2520 DEY           DECREASE POINTER
2530 LDA LBUF,Y    GET CHARACTER
2540 AND #0F       ONLY FOUR BITS

```

as to relieve the programmer of that task. I have often wanted that sort of a feature when I am doing a lot of coding with the S-C assembler. I have included the code that will automatically generate the line numbers in listing 1. It is placed immediately after the multiply routine that is listed in the previous section. The steps that are required to incorporate the routine into the assembler are:

1. BRUN the assembler
2. Enter the source code from listing 1
3. Assemble the code using the assembler
4. Patch an assembler address that will allow access to the auto-line routine. Location \$1388 should contain a JSR \$FD1B. Change the address to \$1D21 using the monitor command:

\*1389:21 1D.

The automatic line number routine is started by typing a control-N instead of a RETURN. So, whenever you type control-N, the assembler will generate a carriage return, a line feed, and then display the next line number on the screen. I incorporated this routine in my assembler and was very happy with it with one exception. In order to change either the starting line number or the increment, you had to change the values stored in memory. This soon got to be very tedious, especially when I had to refer to the source listing in order to find the address that I had to change if I needed a different starting line number or increment. I longed for a command to change one or both of the numbers.

### The 'AUTO' Command for the S-C Assembler

Listing 2 is the code to include the 'AUTO' command to the S-C assembler. The format of the AUTO command is the same as for Integer BASIC, which is:

AUTO starting line number,  
increment.

The design of the routine is quite simple. First the routine goes to the input line buffer and begins to scan the command, beginning with character four. It throws away all characters until it finds a space. This is done so that the user may type any character string that starts with the first three letters 'AUT'. After we have encountered a space, we count the number of characters from there until the comma. This is the number of digits in the starting line number and this value is saved for later use. Note that this value can be zero,

which implies that you can change only the increment, but don't have to change the starting line number also (for example AUTO ,10).

Next we scan the character string, starting with the first character after the comma, and ending with the null byte that terminates the input buffer string. Again the number of characters is saved and, as mentioned above, it also may be zero if you only want to change the starting line number and keep the same increment (for example AUTO 1000). The increment character string is converted from ASCII to BCD by the GETNUM routine. The resulting BCD number for the increment is saved as the new increment. Finally, the starting line number string is converted to BCD and saved as the new starting line number. Then we jump back to the assembler command mode.

Only a small problem now exists—there is no 'AUTO' command in the basic S-C assembler. We have two options: we can find the command dispatch table in the assembler and add another command to it (this may be complicated), or we can replace one of the existing commands with our new command. I chose to do the latter. The code at the end of listing 2 changes the 'JOIN' command to 'AUTO' by changing the ASCII command string and the address of the routine that actually does the command in the command dispatch table. As before, the code needs to be assembled as part of the assembler and saved as indicated above.

I have recommended that you create a source file and assemble that in order to incorporate these new features. This is not necessary, since I have included the object code as part of the listings. Instead, you could just enter the object code directly into memory and make the patches listed above. The only problem that I see with that method, is that it can be very tedious, if you were to make a small mistake. Also, it is a good idea to make yourself a back-up copy of the assembler until you have tested out your new and improved version.

Ned W. Rhodes received his BSEE from the University of Minnesota and his MS in Computer Science from the George Washington University in Washington D.C. He is currently employed by the David W. Taylor Naval Ship Research and Development Center, where he develops high-speed minicomputer-based data acquisition systems for use during full-scale trials aboard naval vessels.

**MICRO**

1E26- 60	2550	RTS	DONE
	2560 *		
	2570 *		
	2580		
	2590 *	SHIFT --	SHIFT LEFT 4 BITS
	2600 *		
	2610 *		
	2620	SHIFT	
1E27- 18	2630	CLC	CLEAR CARRY
1E28- 2A	2640	ROL	LEFT 1
1E29- 2A	2650	ROL	LEFT 1
1E2A- 2A	2660	ROL	LEFT 1
1E2B- 2A	2670	ROL	LEFT 1
1E2C- 60	2680	RTS	RETURN
	2690 *		
	2700 *		
	2710 *	STORAGE	
	2720 *		
	2730 *		
1E2D- 00	2740	SCNT .HS 00	COUNT
1E2E- 00	2750	EPOS .HS 00	POSITION
1E2F- 00 00	2760	HOLD .DA 0	TEMP STORAGE
	2770 *		
	2780 *		
	2790 *	CHANGE JOIN TO AUTO	
	2800 *		
	2810 *		
	2820	.OR \$1289	IN DISPATCH TABLE
1289- 41 55 54	2830	.AS /AUT/	AUTO COMMAND
128C- 7E 1D	2840	.DA AUTO	ADDRESS
	2850	.EN	

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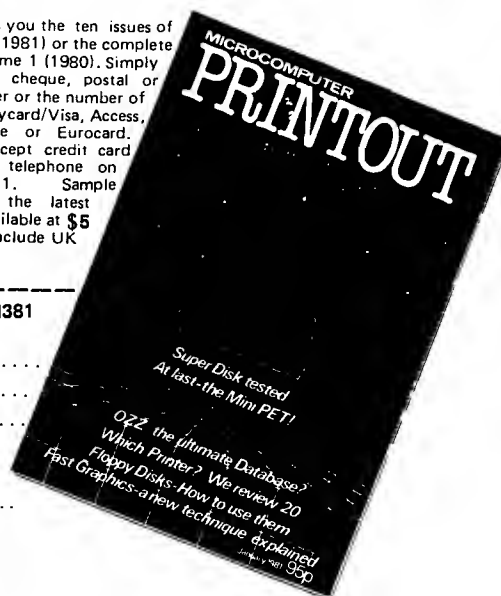
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# PRINT USING for the PET

**This is an excellent PET version of Gary Morris' Apple program. It runs on any PET or CBM machine.**

David Malmberg  
43064 Via Moraga  
Fremont, California 94538

Gary Morris recently published a PRINT USING program for the Apple in the October 1980 issue of *MICRO* (29:14). His program made use of some of the ROM routines in Applesoft. Since Microsoft developed both Applesoft and the various versions of PET BASIC, I felt that Gary's routine could be easily adapted for the PET. After consulting Jim Butterfield's many memory maps of the PET ROMs, and a fair amount of experimentation, I succeeded in modifying Gary's basic routine to work on the PET.

Listing 1 is a BASIC program that POKEs the machine code for the routine into the second cassette buffer (from 826 to 984). This program also detects which of the three versions of BASIC is operable in the specific PET and modifies the machine code accordingly. This is done by PEEKing into location 50003 which contains a "0" for BASIC 2.0, a "1" for BASIC 3.0, and a "160" for BASIC 4.0. The program in listing 1 will also set the USR vector (locations 1 and 2) to point to the beginning of the code in the second cassette buffer. Once this program has been run, the machine language routine is available to any BASIC program via the USR function.

As an example of how this would be used, consider the following BASIC instructions:

```
10 ED$ = "$, 0.00"
20 X = 123456
30 PRINT "TOTAL IS ";Y =
   USR(X)
```

This sequence will cause the following to be printed:

TOTAL IS \$ 1,234.56

The edit pattern to be used in formatting the output must be specified by the string variable ED\$. The edit pattern may contain almost any valid character (such as, \$ #, %, ' = / K . etc.). These characters will be "skipped over" and the various digits of the number will be inserted into the blanks of the edit pattern, or overlaid on any 0's in the pattern. The value to be printed will be edited from right to left. If the value is too large for the edit field, the left-most characters will be truncated. A comma in the pattern will be

printed only if there is at least one digit to the left of it. If the value is negative, the minus sign will be placed to the left of the highest digit.

The value to be edited is passed to the PRINT USING routine as the parameter of the USR function, e.g., X in the previous example. This parameter may be a complex expression, rather than just a variable or a numeric value. The value returned by the USR function to BASIC (Y in the previous example) will be garbage and have no meaning. Be careful not to use a variable name that is significant to the rest of the program as the left hand side of the USR equation.

## Listing 1

```
10 PRINT "ICLRIC 2 DOWN]PRINT USING FOR THE PET"
20 PRINT "IDOWN]BY DAVID MALMBERG"
30 REM ADAPTED FROM A ROUTINE FOR THE APPLE
40 REM BY GARY MORRIS IN OCT-1980 MICRO
50 PRINT "[HOME]          LOADING 2ND CASSETTE BUFFER"
60 FOR I= 826 TO 984 :READ DC:POKE I,DC:PRINT "[HOME]";I,DC:NEXT I
70 REM BASIC 3.0 VERSION
80 DATA 32,233,220,169,69,162,196,139
90 DATA 66,134,67,32,201,207,160,2,177
100 DATA 68,133,93,136,177,68,133,92,136
110 DATA 177,68,201,16,144,2,169,16,141
120 DATA 32,3,168,136,177,92,153,33,3
130 DATA 136,16,248,160,0,185,0,1,240
140 DATA 3,200,208,248,174,32,3,136,185
150 DATA 0,1,72,104,72,201,45,208,14,189
160 DATA 32,3,201,45,144,22,202,208,240
170 DATA 104,24,144,54,189,32,3,201,32
180 DATA 240,8,201,44,240,238,201,48,144
190 DATA 234,104,157,32,3,202,240,32,192
200 DATA 1,208,205,232,24,144,16,189,32
210 DATA 3,201,36,240,17,201,46,176,5
220 DATA 169,32,157,32,3,202,240,5,236
230 DATA 32,3,144,232,174,32,3,169,0,157
240 DATA 33,3,160,3,169,33,32,28,202,169
250 DATA 0,133,7,96
260 POKE 1,58:POKE 2,3:REM SET USR VECTOR
270 IF PEEK(50003)<>160 THEN 310
280 REM BASIC 4.0 MODIFICATIONS
290 POKE 827,147:POKE 828,207:POKE 838,195:POKE 839,193
300 POKE 978,29:POKE 979,187
310 IF PEEK(50003)<>0 THEN 370
320 REM BASIC 2.0 MODIFICATIONS
330 POKE 827,175:POKE 828,220:POKE 838,215:POKE 839,207
340 POKE 978,39:POKE 979,202:POKE 983,94
350 POKE 834,148:POKE 836,149:POKE 843,150:POKE 845,175
360 POKE 848,150:POKE 850,174:POKE 853,150:POKE 866,174
370 PRINT "[I 6 DOWN]LOADING COMPLETED"
```

The routine works by editing the ASCII representation of the number passed as the USR parameter. The routine assumes that this value has been "integerized" and that the ASCII representation does not contain a decimal point. The position of the decimal point (if any) will be implied by the edit pattern, i.e., the variable ED\$.

If the actual value you wish to format has a decimal point, or if you wish to scale the number to be printed differently from the way it is represented internally in the PET, you can use a BASIC user-defined function to handle the conversion before going to the USR routine. For example:

```
10 DEF FNS2(X) = INT (X*100
+ 0.5)
20 DEF FNPK(X) = INT(X/2.21
+ 0.5)
30 ED$ = "$ , 0.00"
40 Y = USR(FNS2(12.3456))
50 ED$ = "KILOS="
60 PRINT
70 Z = 1000.0 : REM POUNDS
80 Y = USR(FNPK(Z))
```

will cause the following output:

```
$ 12.35
KILOS= 452
```

Listing 2 gives the assembler source code for the PET PRINT USING routine. The appropriate ROM routine locations are given for all three versions of PET BASIC, with conditional assembly determined by the value of ROMs in line 100. The assembled code shown along side of the source code is for BASIC 3.0—the "new" ROMs. The assembler source is almost identical to that shown in Gary Morris' original Applesoft article, with the exception of the use of the STROUT ROM routine to print the formatted representation of the number (line 1450). The assembler source also has several slight differences to accommodate the differences between how Applesoft and PET BASICs handle the ASCII representation of numbers, and the value the USR function returns. The assembler source is well-commented and is very straightforward.

## Listing 2

```
0010 ;PRINT USING FOR THE PET
0020 ;BY DAVID MALMBERG
0030 ;43064 VIA MORAGA
0040 ;FREMONT, CALIFORNIA 94538
0050 ;
0060 ;ADAPTED FROM A ROUTINE FOR THE APPLE
0070 ;BY GARY MORRIS IN OCT-1980 MICRO
0080 ;
0090 ;BA $033A
0100 ROMS .DE 3
0110 .OS
0120 STRING .DE $100
0130 LENGTH .DE 800
0140 EDITBUF .DE 801
0150 ;
0160 ;IFE ROMS-3
0170 FLFASC .DE $DCE9
0180 STROUT .DE $CA1C
0190 NAME .DE $42
0200 VARIABLE .DE $44
0210 FIND .DE $CFC9
0220 PNTR .DE $5C
0230 VARTYP .DE $07
0240 ***
0250 ;
0260 ;IFE ROMS-4
0270 FLFASC .DE $CF93
0280 STROUT .DE $BB1D
0290 NAME .DE $42
0300 VARIABLE .DE $44
0310 FIND .DE $C187
0320 PNTR .DE $5C
0330 VARTYP .DE $07
0340 ***
0350 ;
0360 ;IFE ROMS-2
0370 FLFASC .DE $DCAF
0380 STROUT .DE $CA27
0390 NAME .DE $94
0400 VARIABLE .DE $96
0410 FIND .DE $CFD7
0420 PNTR .DE $AE
0430 VARTYP .DE $5E
0440 ***
0450 ;
0460 ;FIRST CONVERT NUMBER PASSED BY USR
0470 ;FUNCTION TO FLOATING ACCUM TO
0480 ;ASCII STRING STARTING AT 'STRING'
0490 ;
033A- 20 E9 DC 0500 JSR FLFASC
0510 ;NOW FIND THE VARIABLE (ED$) TO USE
0520 ;IN THE EDIT PATTERN
0530 ;
033D- A9 45 0540 SEARCH LDA #1E ;BASIC VARIABLE
033F- A2 C4 0550 LDX #C4 ;NAME IS ED$
0341- 85 42 0560 STA #NAME
0343- 86 43 0570 STX #NAME+1
0345- 20 C9 CF 0580 JSR FIND
0348- A0 02 0590 LDY #2
034A- B1 44 0600 LDA (VARIABLE),Y ;GET ADDR HI
034C- 85 5D 0610 STA #PNTR+1
034E- 88 0620 DEY
034F- B1 44 0630 LDA (VARIABLE),Y ;GET ADDR LO
0351- 85 5C 0640 STA #PNTR
0353- 88 0650 DEY
0354- B1 44 0660 LDA (VARIABLE),Y ;GET LENGTH
0356- C9 10 0670 CMP #16
0358- 90 02 0680 BCC LENOK ;MAXIMUM LENGTH
035A- A9 10 0690 LDA #16 ;ALLOWED IS 16!!!
035C- 8D 20 03 0700 LENOK STA LENGTH
0710 ;
0720 ;MOVE THE ED$ PATTERN TO EDITBUF
035F- A8 0730 TAY
0360- 88 0740 DEY
0361- B1 5C 0750 LOOP2 LDA (PNTR),Y
0363- 99 21 03 0760 STA EDITBUF,Y
0366- 88 0770 DEY
0367- 10 F8 0780 BPL LOOP2
0790 ;
0800 ;FIND THE ASCII STRING END
0369- A0 00 0810 LDY #0
036B- B9 00 01 0820 LOOP LDA STRING,Y ;GET CHAR
```

```

036E- F0 03      0830      BEQ EDIT
0370- C8          0840      INY
0371- D0 F8      0850      BNE LOOP
0860      ;MOVE STRING TO THE EDITBUF. FROM RIGHT
0870      ;TO LEFT. FILLING OVER NUMBERS BUT
0880      ;SKIPPING COMMA'S AND PERIODS.
0890      ; IF WE COME TO A MINUS SIGN THEN
0900      ;KEEP GOING LEFT UNTIL THE PATTERN
0910      ;HAS A BLANK OR A COMMA. THEN KEEP
0920      ;GOING LEFT STORING BLANKS IN THE
0930      ;EDITBUF UNTIL IT ENDS OR WE COME
0940      ;TO A DOLLAR SIGN
0950      ;
0373- AE 20 03    0960      EDIT      LDX LENGTH      ;FIELD WIDTH
0970      ;
0376- 88          0980      EDLOOP     DEY
0377- B9 00 01    0990      LDA STRING,Y      ;GET CHARACTER
037A- 48          1000      PHA      ;SAVE IT
037B- 68          1010      CHECK      PLA
037C- 48          1020      PHA
037D- C9 2D      1030      CMP #'-      ;IF A MINUS SIGN
037F- D0 0E      1040      BNE DIGIT      ;SKIP TO A BLANK
0381- BD 20 03    1050      MINUS      LDA EDITBUF-1,X
0384- C9 2D      1060      CMP #'-
0386- 90 16      1070      BCC DROPIT
0388- CA          1080      SKIPIT     DEX
0389- D0 F0      1090      BNE CHECK
038B- 68          1100      PLA
038C- 18          1110      CLC
038D- 90 36      1120      BCC DONE
038F- BD 20 03    1130      DIGIT      LDA EDITBUF-1,X
0392- C9 20      1140      CMP #'
0394- F0 08      1150      BEQ DROPIT
0396- C9 2C      1160      CMP #'
0398- F0 EE      1170      BEQ SKIPIT
039A- C9 30      1180      CMP #0
039C- 90 EA      1190      BCC SKIPIT
039E- 68          1200      DROPIT     PLA      ;GET IT BACK
039F- 9D 20 03    1210      STA EDITBUF-1,X
03A2- CA          1220      DEX
03A3- F0 20      1230      BEQ DONE
03A5- C0 01      1240      CPY #1      ;END OF STRING?
03A7- D0 CD      1250      BNE EDLOOP
03A9- E8          1260      INX
03AA- 18          1270      CLC
03AB- 90 10      1280      BCC NEXT1
03AD- BD 20 03    1290      BLANK      LDA EDITBUF-1,X      ;BLANK FROM
03B0- C9 24      1300      CMP #'$      ;HERE TO $
03B2- F0 11      1310      BEQ DONE
03B4- C9 2E      1320      CMP #'
03B6- B0 05      1330      BCS NEXT1
03B8- A9 20      1340      LDA #'
03BA- 9D 20 03    1350      STA EDITBUF-1,X
03BD- CA          1360      NEXT1     DEX
03BE- F0 05      1370      BEQ DONE
03C0- EC 20 03    1380      CPX LENGTH
03C3- 90 E8      1390      BCC BLANK
03C5- AE 20 03    1400      DONE      LDX LENGTH
03C8- A9 00      1410      LDA #0
03CA- 9D 21 03    1420      STA EDITBUF,X      ;PUT 0 AT END
03CD- A0 03      1430      LDY #H, EDITBUF
03CF- A9 21      1440      LDA #L, EDITBUF
03D1- 20 1C CA    1450      JSR STROUT
03D4- A9 00      1460      LDA #0      ;SET TYPE TO NUMERIC
03D6- 85 07      1470      STA *VARTYP      ;TO AVOID BASIC ERROR
03D8- 60          1480      RTS
03D9- 1490 XEND      .EN

```

LABEL FILE: [ / = EXTERNAL ]

```

/ROMS=0003      /STRING=0100      /LENGTH=0320
/EDITBUF=0321    /FLPASC=DCE9      /STROUT=CA1C
/NAME=0042      /VARIABLE=0044    /FIND=CFC9
/PNTR=005C      /VARTYP=0007    SEARCH=033D
LENOK=035C      LOOP2=0361    LOOP=036B
EDIT=0373      EDLOOP=0376    CHECK=037B
MINUS=0381      SKIPIT=0388    DIGIT=038F
DROPIT=039E     BLANK=03AD     NEXT1=03BD
DONE=03C5      XEND=03D9

```

**MICRO**

# MICRO

## Club Circuit

Mike Rowe  
Club Circuit  
P.O. Box 6502  
Chelmsford, MA 01824

*The following club announcements are presented in zip code order.*

### Richmond Computer Club

Gary F. Cowardin is Treasurer for this group which meets on the last Monday of each month at 7:30 pm at the Science Museum of VA. This club has a membership of over 50 active members who meet to encourage organized computer use involving Ohio Scientific, Heath, TRS-80, Apple, and many other microcomputers. For further information, write:

Secretary  
1004 Lorraine Avenue  
Richmond, VA 23227

### Jacksonville Atari & PET Society (JAPS)

This group meets at various member's homes and businesses to assist members, exchange ideas, information and experiences. Russell A. Grockett, Jr is president for this newly-formed group. For monthly information on club meeting locations contact the president at (904) 725-0435 evenings and weekends. Or write to:

401 Monument Road #171  
Jacksonville, FL 32211

### 6502 User's Group

Chairman Gerald Key heads this group of 28+ members which meets every 3rd Thursday of the month at 7:30 pm. Meetings are held at the State Savings Bank Community Room, 444 Havens Corner Road, Gahanna, OH. This club states its purpose as a means to exchange ideas, provide assistance to members, and promote the use of microcomputers. This club provides a forum for all 6502-based users and is the only Columbus area alternative to many Apple user's groups. For further information, write:

Chairman  
141 Flintridge Drive  
Gahanna, OH 43230

(Continued on page 20)

# 80 COLUMN GRAPHICS



The Integrated Visible Memory for the PET has now been redesigned for the new 12" screen 80 column and forthcoming 40 column PET computers from Commodore. Like earlier MTU units, the new K-1008-43 package mounts inside the PET case for total protection. To make the power and flexibility of the 320 by 200

The image on the screen was created by the program below.

```
10 VISMEN: CLEAR
20 P=150: Q=100
30 XP=144: XR=1.5*3.1415927
40 YP=55: YR=1: ZP=64
50 XT=XR/XP: YP=YP/YR: ZP=ZP/ZP
60 FOR ZI=0 TO Q-1
70 IF ZI=ZP OR ZI=ZP GOTO 150
80 ZT=ZI*XP/YP: ZI=ZI
90 XL=INT(.5+SQR(XP*XP-ZT*ZT))
100 FOR XI=XL TO XL
110 XT=SQR(XI*XI+ZT*ZT)*XP: XX=XI
120 YY=(SIN(XT)+.4*SIN(3*XT))*YP
130 GOSUB 170
140 NEXT XI
150 NEXT ZI
160 STOP
170 X1=XX+ZT*P
180 Y1=YY-ZT*Q
190 GMODE 1: MOVE X1,Y1: WRPIX
200 IF Y1=0 GOTO 210
210 GMODE 2: LINE X1,Y1-1,X1,0
220 RETURN
```

bit mapped pixel graphics display easily accessible, we have designed the Keyword Graphic Program. This adds 45 graphics commands to Commodore BASIC. If you have been waiting for easy to use, high resolution graphics for your PET, isn't it time you called MTU?

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**NOW 80 COLUMN PETS CAN HAVE MTU HIGH RESOLUTION GRAPHICS**



# MEMSEARCH for the AIM 65

"MEMSEARCH" is a machine language utility program which quickly scans through memory searching for a user-specified sequence. It can assist in locating an ASCII string or an instruction code group. A wild card feature allows for partial matching of sequences up to 16 bytes long.

Bob Kovacs  
41 Ralph Road  
West Orange, New Jersey 07052

Have you ever had to manually search through memory to look for a certain sequence? Whether you're searching for a particular series of op-codes or ASCII text, doing it with the help of a dump utility or even a disassembler can be painfully slow and prone to error. Clearly this is another job for the computer! The machine language routine described here will accept up to a 16-byte sequence (easily increased if that isn't enough) and identify the starting locations of any matching sequences within the memory range specified by the user.

Although this program was specifically written for use on the AIM 65, using existing monitor routines whenever possible, it shouldn't be too difficult to adapt it to any other 65XX system.

## The Program

The flow diagram in figure 1 defines the major events and decision points in memory search routine. Entry point labels are also included to relate these functions to the implementation (see program listing in figure 2).

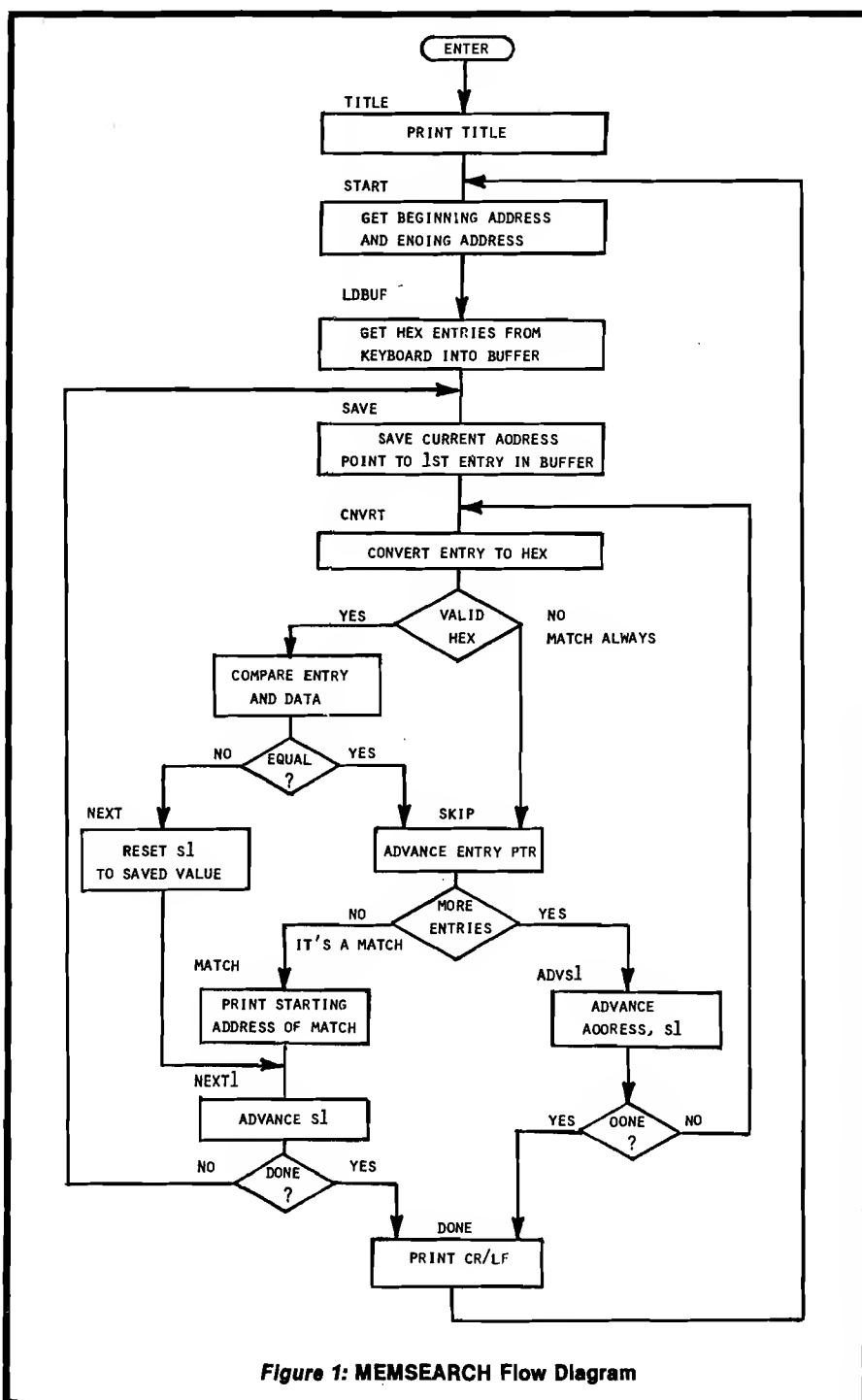


Figure 1: MEMSEARCH Flow Diagram

The program begins by establishing a memory search range and the data sequence to be found. This sequence is stored in a buffer using keyboard entry format (2 ASCII bytes per hex byte entry) and is converted to its numerical equivalent each time it is compared to memory. Although this approach is not terribly efficient, it was necessary in order to allow for wild card or don't-care entries, and still permit all 256 possible byte values for valid comparisons. I'm sure that other approaches could have been used to speed up execution time somewhat, but this method is still fairly fast. The worst case of a search through 4K of memory (when all but the 16th entry always match) takes about 6 seconds to complete.

The main body of the program operates by comparing the entry sequence to the data within the memory bounds specified by the user. This is performed one byte at a time, starting with the first entry and then searching for a corresponding value in memory. If a match is found, then the second entry is compared to the contents of the next memory location only. This operation is repeated, always comparing the next entry with the data in the next memory location. If successive successful comparisons exhaust the total number of entries in the buffer, then the entire entry sequence has been matched. At this point the memory address corresponding to the first entry is output, and the search continues at the memory location following the matched sequence.

If at any point an entry fails to match the contents of memory, then the starting address corresponding to the first entry is incremented by one, and the entire operation begins again.

A number of monitor routines were used in MEMSEARCH to minimize its length (192 bytes program and 36 bytes variable space). A summary of the monitor routines used here is shown in figure 3. Along with the name and entry point is a brief description of what the routine does. Those registers affected by that call to the monitor are also listed.

Figure 2

0800	1	;
0800	2	;
0800	3	;
0800	4	;
0800	5	;MEMSEARCH FOR AIM 65
0800	6	; BY BOB KOVACS
0800	7	; 41 RALPH ROAD
0800	8	; WEST ORANGE, NJ 07052
0800	9	;
0800	10	;ALL KEYBOARD ENTRIES
0800	11	; IN HEXADECIMAL
0800	12	;NONHEX ENTRIES--"DON'T CARE"
0800	13	;
0800	14	;ALL MATCHES RETURN BEGINNING
0800	15	; ADDRESS OF SEQUENCE
0800	16	;
0400	17	ORG \$400
0400	18	OBJ \$800
0400	19	FROM EQU \$E7A3
0400	20	TO EQU \$E7A7
0400	21	MOVE EQU \$F910
0400	22	LDAY EQU \$EB58
0400	23	PACK EQU \$EA84
0400	24	NUMA EQU \$EA46
0400	25	OUTPUT EQU \$E97A
0400	26	REDOUT EQU \$E973
0400	27	BLANK EQU \$E83E
0400	28	CRLF EQU \$E9F0
0400	29	QM EQU \$E7D4
0400	30	STIY EQU \$A427
0400	31	ADDR EQU \$A41C
0400	32	S1 EQU \$A41A
0400	33	;
0400	34	;
0400	35	;OUTPUT TITLE
0400 A000	36	TITLE LDY #\$00
0402 B9BD04	37	TITLE1 LDA MSG,Y
0405 F006	38	BEQ TITLE2
0407 207AE9	39	JSR OUTPUT
040A C8	40	INY
040B D0F5	41	BNE TITLE1
040D 20F0E9	42	TITLE2 JSR CRLF
0410	43	;
0410	44	;GET BEGINNING & ENDING ADDRESSES
0410 20A3E7	45	START JSR FROM
0413 B0FB	46	BCS START
0415 203EE8	47	JSR BLANK
0418 2010F9	48	JSR MOVE
041B 20A7E7	49	START1 JSR TO
041E B0FB	50	BCS START1
0420	51	;
0420	52	;PROMPT USER FOR HEX INPUT
0420 20D4E7	53	LDBUF JSR QM
0423 203EE8	54	JSR BLANK
0426 A200	55	LDX #\$00
0428	56	;
0428	57	;GET ENTRY PAIRS & STORE IN BUF
0428	58	;EXIT ENTRY MODE WITH CR
0428 2073E9	59	LDBUF1 JSR REDOUT
042B C90D	60	CMP #\$0D
042D F011	61	BEQ LDBUF2
042F 9DCA04	62	STA BUFHI,X
0432 2073E9	63	JSR REDOUT
0435 9DDA04	64	STA BUFLO,X
0438 203EE8	65	JSR BLANK
043B E8	66	INX
043C E010	67	CPX #\$10
043E 90E8	68	BCC LDBUF1

```

0440 8EC904 69 LDBUF2 STX ENTCNT
0443 20F0E9 70 JSR CRLF
0446 71 ;
0446 72 ;SAVE CURRENT ADDRESS
0446 AD1AA4 73 SAVE LDA S1
0449 8DC704 74 STA TEMP1
044C AD1BA4 75 LDA S1+1
044F 8DC804 76 STA TEMP2
0452 77 ;
0452 78 ;READ BUF & CONVERT TO HEX
0452 79 ;NON-HEX ACTS AS DON'T CARE
0452 A200 80 LDX #$00
0454 BDCA04 81 CNVRT LDA BUFHI,X
0457 2084EA 82 JSR PACK
045A B014 83 BCS SKIP
045C BDDA04 84 LDA BUFLO,X
045F 2084EA 85 JSR PACK
0462 B00C 86 BCS SKIP
0464 87 ;
0464 88 ;COMPARE TO DATA AT ACTIVE ADDRESS
0464 A000 89 LDY #$00
0466 A91A 90 LDA #$1A
0468 2058EB 91 JSR LDAY
046B CD29A4 92 CMP STIY+2
046E D01E 93 BNE NEXT
0470 94 ;
0470 95 ;MATCH OR DON'T CARE
0470 E8 96 SKIP INX
0471 ECC904 97 CPX ENTCNT
0474 B007 98 BCS MATCH
0476 20A804 99 JSR ADVS1
0479 B027 100 BCS DONE
047B 90D7 101 BCC CNVRT
047D 102 ;
047D 103 ;GOT A MATCH!
047D 104 ;OUT SAVED ADDRESS
047D ADC804 105 MATCH LDA TEMP2
0480 2046EA 106 JSR NUMA
0483 ADC704 107 LDA TEMP1
0486 2046EA 108 JSR NUMA
0489 203EE8 109 JSR BLANK
048C D00C 110 BNE NEXT1
048E 111 ;
048E 112 ;NO OR PARTIAL MATCH
048E 113 ;BACK-UP ACTIVE ADDRESS
048E ADC704 114 NEXT LDA TEMP1
0491 8D1AA4 115 STA S1
0494 ADC804 116 LDA TEMP2
0497 8D1BA4 117 STA S1+1
049A 20A804 118 NEXT1 JSR ADVS1
049D B003 119 BCS DONE
049F 4C4604 120 JMP SAVE
04A2 121 ;
04A2 122 ;NO MORE DATA--START AGAIN
04A2 20F0E9 123 DONE JSR CRLF
04A5 4C1004 124 JMP START
04A8 125 ;
04A8 126 ;COMPARE & BUMP ADDRESS PTR
04A8 AD1AA4 127 ADVS1 LDA S1
04AB CD1CA4 128 CMP ADDR
04AE AD1BA4 129 LDA S1+1
04B1 ED1DA4 130 SBC ADDR+1
04B4 EE1AA4 131 INC S1
04B7 D003 132 BNE ADV
04B9 EE1BA4 133 INC S1+1
04BC 60 134 ADV RTS
04BD 135 ;
04BD 136 ;

```

(continued)

## Using the Program

Load MEMSEARCH through the assembler using the listing in figure 2. Save the program on tape using the 'DUMP TO TAPE' command from \$400 to \$4BF.

After loading MEMSEARCH, begin its execution using the '\*' and 'G' commands. The beginning address and ending address +1 are entered in response to the 'FROM' and 'TO' prompts. The sequence to be found is entered following the '?' prompt. Values are in hex notation without spaces between bytes (spaces are automatically inserted). Two characters must be entered per byte, and up to 16 bytes can be specified. Non-hex entries act as wild cards and match anything. Terminate the sequence (if less than 16 bytes) with a carriage return. The addresses of any matching data sequences in memory are output and the program loops back to search a new memory block.

## Applications

What can MEMSEARCH be used for? Well, everyone has his own needs. I was prompted to write MEMSEARCH in order to locate certain entry points and page zero usage in the AIM 65 BASIC interpreter. Unfortunately Rockwell hasn't provided much information in this area. Nevertheless, I suspected that this was a version of Microsoft BASIC similar to the one known as Applesoft (used in the Apple II). Although quite a bit is known about Applesoft, the memory locations used in the Apple and AIM weren't necessarily the same. Thus the code wouldn't be the same (hence the need for a wild card). With the help of MEMSEARCH I was able to identify the required entry points and page zero locations in a minimum of time.

---

Bob Kovacs is an electro-optics engineer at Bendix where he is currently responsible for the development of a charge-transfer imaging system used for celestial navigation. He is using an AIM 65 for imager sequencing, data collection and processing in the evaluation of a breadboard system. At home, Bob is involved with hardware/software projects on his Apple II. He also enjoys skiing, gardening and photography.

---

## MICRO Club Circuit

(Continued from page 15)

### Apple II Computer User's Group

Rod Nelson, President, William T. Davis Secretary preside over this club boasting a membership of 276. Meetings are held on the first Thursday of each month at 7:00 pm, at the Colorado School of Mines, Golden, CO. The group meets to help each other learn and enjoy computing with Apples. Contact:

Secretary  
P.O. Box 17467  
Denver, CO 80217

### Las Cruces Computer Club

This dual Apple/TRS-80 users group meets on the first Thursday of each month at 7:30 pm at the SW Computer Center (121 Wyatt Suite 7, Las Cruces, NM 88001). Leonard Fetterhoff is club president for 25 members. For further information contact the club secretary:

John Martellaro  
2929 Los Amigos Ct. Apt. B  
Las Cruces, NM 88001

### Original Apple Corps

Kip J. Reiner is president for this club of 300 members. Meetings are held on the second Sunday of the month at noon at UCLA campus, Young Hall, Room 2224, Los Angeles, CA. This group publishes a club magazine, "Apple-sauce" for \$15.00 a year. They meet to expand the knowledge of Apple computers, hardware and software. For further information, write:

Secretary  
19041-2 Hamlin Street  
Reseda, CA 91335

### Apple-Can

This 200+ membership club meets at 7:30 on the first Wednesday of each month, currently at Forest Hill Public Library. Louis H. Milrad is the club president. This club features many guest speakers and promotes the better understanding of the Apple computer, its applications and limitations. They publish a bimonthly newsletter. Many active subgroups in Telecommunications, Medical, Pascal, Forth, Introduction to BASIC, Games, Business, etc, all with an extensive program library. For further information, contact:

Secretary  
Suite 204  
2 Gloucester Street  
Toronto, Ontario, CANADA  
M4Y 1L5

```

04BD 4D454D 137 MSG ASC 'MEMSEARCH'
04C0 534541
04C3 524348
04C6 00 138 BYT $00
04C7 00 139 TEMP1 BYT $00
04C8 00 140 TEMP2 BYT $00
04C9 00 141 ENTCNT BYT $00
04CA 313233 142 BUFHI ASC '12345678'
04CD 343536
04D0 3738
04D2 313233 143 ASC '12345678'
04D5 343536
04D8 3738
04DA 313233 144 BUFLO ASC '12345678'
04DD 343536
04E0 3738
04E2 313233 145 ASC '12345678'
04E5 343536
04E8 3738
    
```

Name	Address	Registers Changed	Description
FROM	E7A3	A,X,Y	Output 'FROM' prompt; user inputs 4 character hex address (ESC & DEL are active) which is stored @ADDR. Carry set if non-hex value entered.
TO	E7A7	A,X,Y	Same as FROM except for prompt.
REDOUT	E973	A	Return with a single character from keyboard in accumulator. Echo to output device unless CR input.
MOVE	F910	A,X	2-byte move from ADDR to S1.
LDAY	EB58	A	Performs a LDA (S1),Y without using page zero. Enter with accumulator pointing to S1 via offset from \$A400 base address.
PACK	EA84	—	Converts ASCII character in accumulator into hex and packs it with previous value (saved in STTY+2). If not hex (i.e. 0-9,A-F) then original character is returned with carry set.
NUMA	EA46	—	Output contents of accumulator as 2 character hex.
OUTPUT	E97A	—	Output ASCII code in accumulator to active output device(s).
BLANK	E83E	A	Output a single space.
CRLF	E9F0	A	Output a carriage return and line feed.
QM	E7D4	A	Output a question mark.

Figure 3: AIM 65 Monitor Routine Summary

MICRO

## ASCII EXPRESS II

by BILL BLUE

Described in INFOWORLD as "The finest program for Apple data communications..." ASCII EXPRESS II allows your Apple to communicate with virtually any computer with dial-up access.

Written in Applesoft and Machine language, Ascii Express II includes everything you'd expect in a complete communications package. It features a variety of powerful features including full support of upper/lower case, autodial and answer capabilities (when used with the Hayes Micromodem), and file oriented upload/download facilities.

A built-in line editor gives full editing functions, and programmable keyboard MACROS reduce complicated log-in procedures to a few simple keystrokes.

Downloaded files may be printed while being received, saved to disk, or printed later when offline. The copy mode allows everything shown on the screen to be saved in the large (20K) buffer.

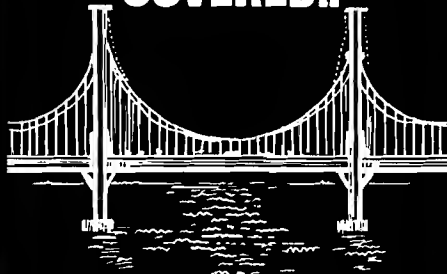
Ascii Express II works with the Hayes Micromodem II, Apple communications card, the CCS Asynchronous Serial card, SSM-AIO Board, Lynx Telephone Linkage System, and many other communications devices.

Uses include:

- Send/receive letters/files from networks like the SOURCE, MICRONET, or other bulletin board type systems.
- Transferring program files between Apples, an Apple and a TRS-80, PET, etc.
- Use the Apple as a terminal to a mainframe at a remote location with the added advantage of being able to process data at the Apple before or after transfer.
- Minimize on-line costs by quickly transferring files and other data.

System requirements include a 48K Apple with Applesoft in ROM or the Language Card, a disk drive, and one of the above communications devices. A lower case display board is recommended, but not required.

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by BILL BLUE

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ONLINE includes a versatile mail system and built-in line editor with provisions for uploading and downloading programs and files.

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Requires 48K Apple with Hayes Micromodem and DOS 3.3.

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by BILL BLUE

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- Terminal emulation allows you to define what kind of terminal your Apple should appear as.
- Entirely in machine language for maximum speed and power.

Z-TERM fully supports the Hayes Micromodem, Apple Communications card, SSM-AIO board, CCS Asynchronous Serial Card, Lynx Communications system and others! Fully supports the local Apple 40 column screen, external terminals, and all 80 column boards interchangeably and with NO configuration necessary!

If you have a Z-80 card, you owe it to yourself to check this one out before you buy any communications software. If you don't have the Z-80 Softcard, you may want to get one just to run this package!

\*Note: CP/M and Apple DOS files are not directly compatible.



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# Joysticks for the OSI C4

**You can do better than to buy OSI joysticks for the C4P. Here's how to make and test your own.**

Charles Platt  
P.O. Box 556  
New York, New York 10011

The Ohio Scientific Challenger C4 is designed for use with joysticks, which are available from the manufacturer as an optional extra. Anyone who really enjoys playing and/or programming video games will want to take advantage of this feature, since it is much easier to control a game with joysticks than by pressing keys on the keyboard. However, Ohio Scientific joysticks are expensive, not as strong as one would like, and often out of stock at one's local OSI dealer. Having learned these hard facts of life, I decided to take matters into my own hands. Either I would convert Atari joysticks (which are very widely available and not too highly priced), or I would make my own.

## Joystick Operation

During a game program the computer needs to know in which direction each joystick is being pushed by the player(s), and whether the "action key" on each joystick is being pressed.

Inside the joystick assembly are four switches which close, one at a time, when the stick is pushed up, down, left, or right. If the stick is pushed diagonally, two of the four switches close simultaneously. In addition there is a fifth switch which is closed when the player pushes the action key.

The computer detects these switch closures via a POKE command in the game program. For example, POKE 57088,128 directs the computer's attention to Joystick A. If the program next asks for a PEEK c memory location 57088, this will yield a number which corresponds to which switches are closed inside the joystick assembly.

This routine is similar to a keyboard PEEK routine, and the joysticks can be thought of as extensions to the keyboard.

There is a chart on page 90 of the old C4 user's manual, giving the possible PEEK numbers and the joystick positions which they represent. Unfortunately, the column headings in this chart are incorrect. The figures in the columns headed "Action Key Depressed" are in fact produced when the action key is not depressed, while the figures in the "Action Key Not Depressed" column are in fact produced when the action key is depressed. If you write your own game program it is important to bear this in mind. This has been corrected in the 1981 version of the C4P User's Manual.

## Connecting Non-C4 Joysticks

There are four trapezoidal sockets on the back panel of the C4, adjacent to the fan. The top socket is for Joystick A, the next one down is for Joystick B. (The other two sockets are for keypads A and B.)

Neither the C4 user's manual nor the maintenance manual gives precise information about which pin does what, in the joystick sockets. However, some trial-and-error tests revealed the functions that follow.

Looking at the outside of the socket, numbering the pins from left to right, the top row of pins in each socket can be labelled pins 1 through 5, and the bottom row, pins 6 through 9. In this case, pin 1 is the ground, pin 2 connects to the action key, pin 3 connects to the "Left" switch in the joystick, pin 4 goes to the "Down" switch, pin 5 to the "Right" switch, and pin 6 to the "Up" switch. Pins 7, 8, and 9 are unconnected.

My first experiment was with Atari joysticks. By a rare fluke of standardization in the computer industry, the

Atari joystick plug exactly fits the C4 joystick socket. Moreover, the switching inside the Atari joystick unit is similar to the switching of C4 joysticks, and there are precisely six wires in the Atari connecting cable—just right for the six active pins in the C4 socket.

There is one snag however. If you look in the holes in the Atari plug, you will find that not all of them contain metal connectors. Some holes are not used and do not connect to anything. Unfortunately, these holes correspond with pins in the C4 socket which *are* used and *must* be connected to something. So you have to slice open the molded plastic Atari plug to get at the metal connectors, which must be reshuffled into the right sequence, leaving holes 7, 8, and 9 empty to correspond with unused C4 pins 7, 8, and 9.

The Atari wires are color coded and should be matched to the C4's pin numbers as follows:

Black	Pin 1
Orange	Pin 2
Green	Pin 3
Blue	Pin 4
Brown	Pin 5
White	Pin 6

Once you have opened the plug and extracted the little metal connectors which slide onto the pins in the joystick socket (some connectors may be torn loose in the plug-opening operation and will need to be resoldered to their wires), you can slide these connectors individually onto their separate pins, and separate them with small pieces of electrical tape to prevent accidental shorts. You can then test the joystick, using the procedure described later in this article.

When you're sure the joystick is working properly, and all your connections have been made correctly, you can drip some quick-setting epoxy over the metal connectors to encapsulate

them. When the epoxy is dry, the connectors can be slipped off the pins in one unit. The epoxy has, in fact, created a new "plug" around the connectors, to replace the original plug which had to be sliced open.

## Making Your Own Joysticks

After using Atari joysticks for a while, I became dissatisfied with their response and decided to build my own. This turned out to be extremely simple.

Each joystick unit consists of a box with a wooden top and bottom and aluminum sides. (The thin aluminum is bent around the wood and nailed to it.) The stick is pivoted where it is screwed to the bottom of the box; some self-centering action is provided by a small compression spring. The stick protrudes through a 1" square hole in the top of the box. Arranged around this hole, screwed to the underside of the top of the box, are four microswitches, positioned so that their contact buttons are just touching the four sides of the stick (which has a square cross-section at this point). Lastly, a pushbutton is mounted on the outside of the top of the box to serve as the action key.

Using microswitches allows a much more positive "feel" than is available from the Atari joysticks. My home-made units provide much more precise control of video games.

## Checking Joystick Operation

To make sure you have wired your home-made or Atari joysticks correctly, you can run a simple "POKE and PEEK" test program.

### Program for Joystick A

```

10 POKE 2073,96:REM —
  DISABLES CONTROL-C.
  THE ROUTINE WON'T
  FUNCTION TILL YOU DO
  THIS.
20 FOR K = 1 TO 200:REM —
  SEE NOTE BELOW
30 POKE 57088,128:REM —
  ACTIVATES JOYSTICK A
40 P = PEEK(57088) AND
  31:REM — PEEK JOYSTICK A
50 PRINT P
60 FOR D = 1 TO 200:NEXT
  D:REM — DELAY LOOP
70 NEXT K
80 END

```

Since "Control-C" has been disabled in the program, there is no way of stopping the program once it has started, short of hitting the Break key. So a loop is used, incrementing K by 1 in each of 200 cycles. The program ends at the end of the loop. A delay loop is also used, to stop the figures from racing uncontrollably across the screen.

*Note:* line 30, the POKE command, is inside the K loop. This is because you must POKE 57088 again after each time you have PEEKed it and it has yielded data. If you write a program which repeatedly PEEKs 57088 for data and does not re-POKE it each time, you will find that the joysticks won't work properly. For a demonstration of this fault, you can run the sample program listed on page 93 of the old C4 user's manual, or pages 45-47 in the new manual. This program erroneously fails to POKE 57088 after PEEKing it. Consequently, as listed, the program doesn't work.

When you test Joystick A, using the test program shown here, you should find that moving the stick generates, on the video screen, the various numbers listed on page 90 of the old manual, page 43 in the new manual. If the numbers are as listed, but they appear in the wrong sequence, you've probably made an incorrect connection in the joystick socket. If the numbers on the screen do not in any way match the numbers in the manual, you have probably made a programming error. Be sure that your PEEK command is PEEK[57088] AND 31. Without the "AND 31" it won't work.

If you are using Atari joysticks and you find that pushing the stick directly up and down, or from side to side, produces numbers which wrongly indicate diagonal motion, the problem is simply that you are pushing the stick too hard, thus turning on two switches instead of only one at a time. Only very light pressure is required.

Once you have tested Joystick A, you can test Joystick B by rewriting two lines of the test program:

```

30 POKE 57088,16
40 P = PEEK(57088) AND 248

```

These are the POKE and PEEK which give access to Joystick B.

Happy game playing!

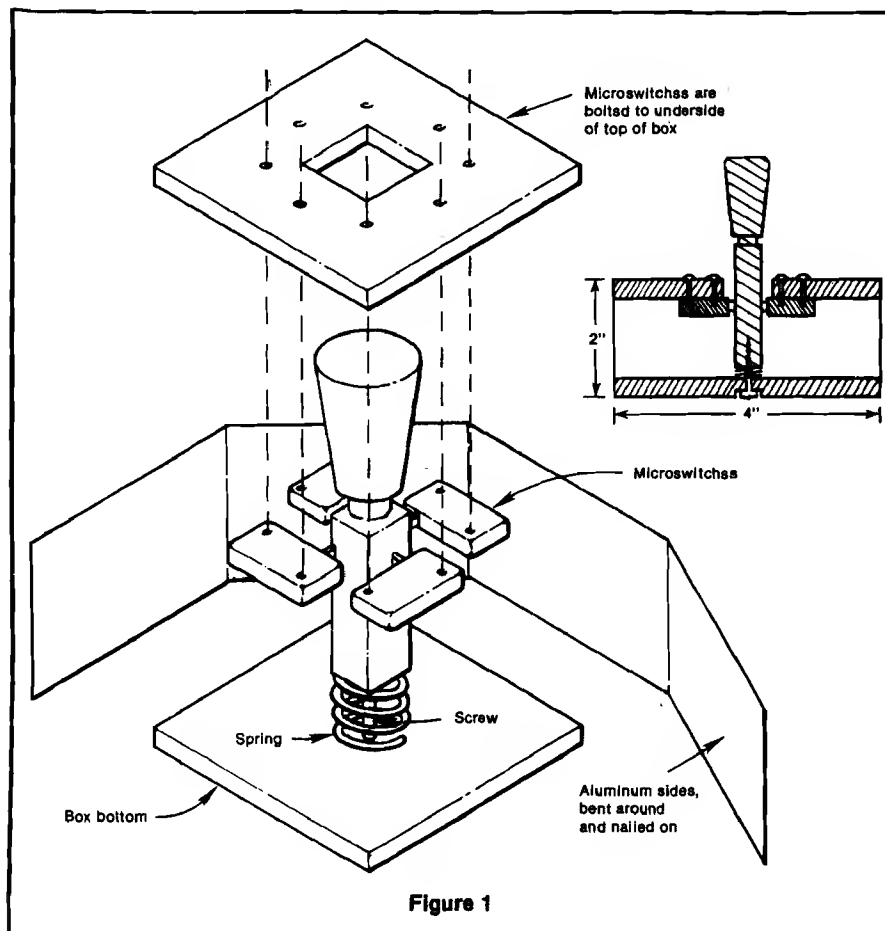


Figure 1

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**A.** Yes. You can insert lines or delete any lines from the text.
- Q. How about text I have captured. Can I edit that?**  
**A.** As easily as the text you have prepared yourself. You can delete any lines you don't want to print or save to a disk file. You can also insert lines into the text.
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**A.** If the system with which you are communicating accepts a stop character, most use a Control S, you can capture an unlimited amount of text.
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**A.** When the text buffer is full the stop character is output to the other system. Then DATA CAPTURE 4.0 writes what has been captured up to that point to a disk file. This is done automatically.
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**A.** Control is returned to you and you can send the start character to the other system. This generally requires pressing any key, the RETURN key or a Control Q.
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# Apple Memory Maps, Part 1

**Your Apple can draw accurate memory maps of Integer BASIC and Applesoft programs, together with their associated variables, arrays, and strings, by using the information contained in various pointers. DOS, MAXFILES, and RAM Applesoft can also be displayed.**

Peter A. Cook  
1443 N. 24th Street  
Mesa, Arizona 85203

*This article will be presented in two parts. Part 1 contains examples of memory maps produced by the Apple, which show where the computer stores programs in its memory. Part 2 will contain the "Memory Map" program listing and a description of how it works.*

Memory maps show where computers store data in their memories. A 48K Apple actually has 65,536, or 64K, memory locations in which data can be stored. Locations 0 to 49151, the first 48K, are available for storing changeable information (Random Access Memory), while locations 49152 to 65535, the last 16K, are for permanently-installed data which can't be changed by the user (Read Only Memory). The computer places data into specific locations in the RAM memory area, depending on what type data it is, and which language is being used.

Various charts in the Apple reference manuals show where programs are stored in RAM, along with their associated variables, arrays and strings. The disk and cassette versions of Applesoft are also stored in this area, and so is the Disk Operating System and its file buffers. The charts are adequate for simple programs, but for more complex ones you need to know exactly how much space is used by the different program components. This is especially important if the Hi-Res graphics pages are used, or if machine language subroutines are included.

APPLE II	Applesoft Card		NO CARD
	Switch up	Switch down	
DOS 'INT'	Integer BASIC	Integer BASIC	Integer BASIC
DOS 'FP'	ROM Applesoft	ROM Applesoft	RAM Applesoft (disk)
no DOS	ROM Applesoft	Integer BASIC	Integer BASIC
		RAM Applesoft (cassette)	RAM Applesoft (cassette)

**Figure 1: Language availability for various configurations of the Apple II.**

## Description

The following maps cover the Apple's RAM memory area from 2048 to the highest available RAM location in your machine. The area from 0 to 2047 is not included because it is used by the computer for various internal functions and is not generally available for BASIC programs.

The MEMORY MAP program will provide the following information:

1. Maximum amount of RAM available.
2. Whether or not DOS has been booted.
3. Number of DOS file buffers reserved (MAXFILES).
4. Current language in use.
5. Whether or not a program has been loaded, or run.
6. Location and length of program, variables, arrays, and strings.
7. Amount of free space remaining.
8. Setting of LOMEM and HIMEM.
9. Location of Hi-Res graphics pages.
10. Extent of the "garbage collection" of old strings.

The program will work with all versions of the Apple II or Apple II Plus, ranging in size from 16K to 48K, with either the old monitor ROM or the new autostart ROM installed. It will accept programs from cassette as well as disk, but it will only work with DOS version 3.2.

The program was designed for use with Integer BASIC, RAM Applesoft, or ROM Applesoft. However, I do not know what the results will be if you use these languages with the Pascal language system installed. Language availability for various configurations of the Apple II is shown in figure 1.

## Integer BASIC Memory Maps

The following examples show how the MEMORY MAP program can be used with Integer BASIC programs. We will use a 48K Apple II with Applesoft card in slot 0, printer in slot 2, and disk drive in slot 6. For the first example, turn on the computer without loading DOS. Enter the monitor and load the

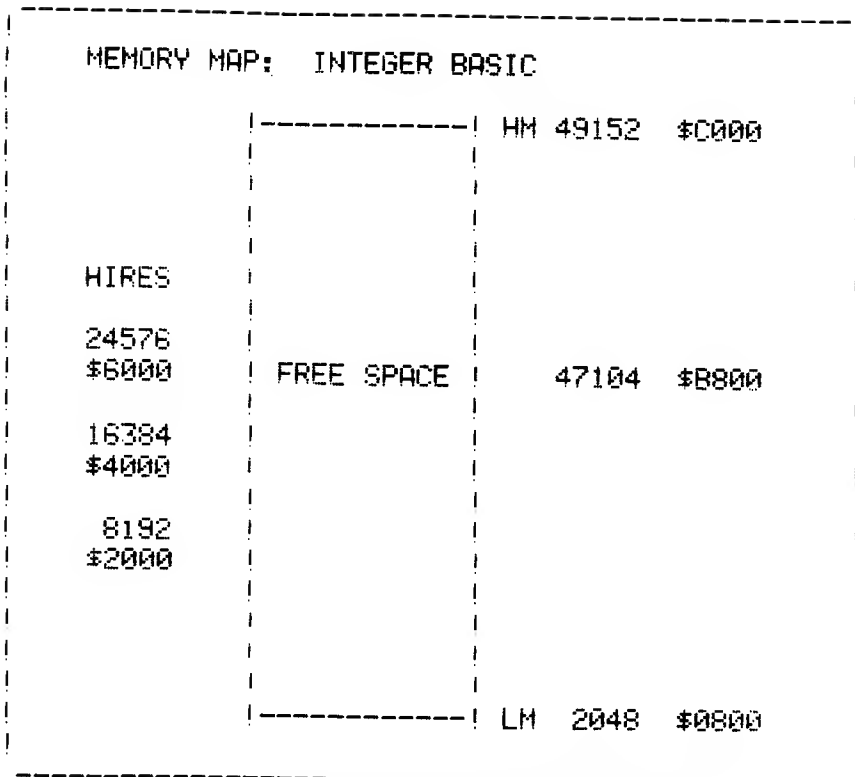


Figure 2: Integer BASIC map with nothing in memory.

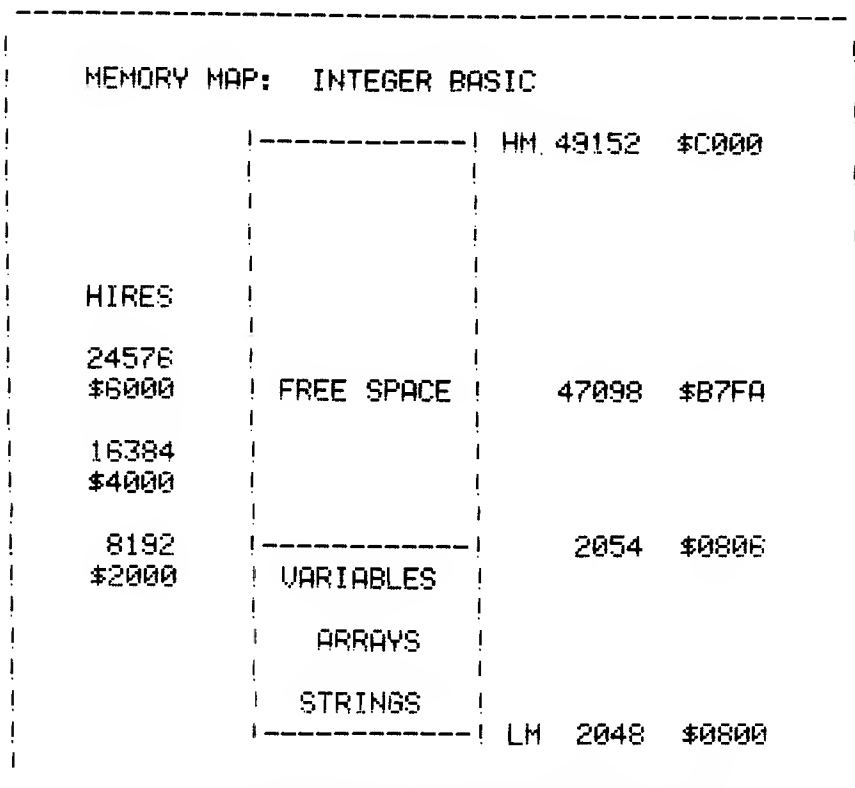


Figure 3: Integer BASIC map showing area for variables.

MEMORY MAP: INTEGER BASIC			
HIRES 24576 \$6000 16384 \$4000 8192 \$2000	PROGRAM	HM 49152	\$C000
		49138	\$BFF2
	FREE SPACE	47090	\$B7F2
		LM 2048	\$0800

Figure 4: Integer BASIC map showing program area.

MEMORY MAP: INTEGER BASIC			
HIRES 24576 \$6000 16384 \$4000 8192 \$2000	PROGRAM	HM 49152	\$C000
		49138	\$BFF2
	FREE SPACE	47084	\$B7EC
	VARIABLES	2054	\$0806
	ARRAYS		
	STRINGS		
		LM 2048	\$0800

Figure 5: Integer BASIC map after running program.

MEMORY MAP machine language program from cassette. Enter BASIC and use CALL 13000 to run it. More detailed loading instructions will be provided in Part 2, along with the actual program itself.

```
3200.38DFR
Control B
CALL 13000
```

Figure 2 shows that LOMEM is set at 2048, HIMEM is set at 49152, and 47,104 bytes of free space are waiting to be used.

Now define a simple variable and call MEMORY MAP again.

```
A = 1
CALL 13000
```

Figure 3 shows that the variable is stored just above LOMEM and contains 6 bytes, as do all simple variables in Integer BASIC.

Clear the variable and enter the same statement in the form of a program.

```
Reset, Control B
10 A = 1
20 END
CALL 13000
```

Notice that the program has been stored just below HIMEM, as shown in figure 4.

Load the program again, and this time run it to see what happens.

```
Reset, Control B
10 A = 1
20 END
RUN
CALL 13000
```

The program creates the same variable in figure 5 that was entered in figure 3.

Now load the DOS. Type INT to remove the greeting program, then re-enter the above program and run it. The DOS boot will clobber MEMORY MAP, so it too will have to be reloaded. Now that we have DOS, we can use BRUN MEMORY MAP instead of the separate commands for loading and calling 13000.

```
Reset, Control B
PR#6
INT
10 A = 1
20 END
RUN
BRUN MEMORY MAP
```

Figure 6 shows the large amount of space used by the DOS and its file buffers. The default number of buffers, three, has been reserved and HIMEM has been reset to 38400.

For a more complex case, let's reserve the maximum number of file buffers, 16, drastically change the values of LOMEM and HIMEM, and run our same program again. Be aware that LOMEM: and HIMEM: are not legal Integer BASIC commands, but can be used with DOS.

```
INT
MAXFILES 16
LOMEM: 14000
HIMEM: 15000
10 A = 1
20 END
RUN
BRUN MEMORY MAP
```

The memory map in figure 7 shows that everything has been set as specified. Note the small amount of free space remaining.

### Applesoft Memory Maps

Applesoft stores everything quite differently than does Integer BASIC. To demonstrate, type FP to change languages and clear the preceding program, then call MEMORY MAP.

```
FP
CALL 13000
```

Figure 8 shows that the program storage area is now at the bottom of memory instead of at the top. With no program loaded, the program pointer starts at 2049 and the end of program pointer starts one or two bytes higher. LOMEM is set above the program. Location 2048 contains a "0" because each program line must be preceded by a zero.

In Applesoft, the variables, arrays, and strings are all stored in separate areas instead of in the one combined area used by Integer BASIC. We can see this by creating some simple examples and looking at the result with MEMORY MAP.

```
A = 1
DIM B(10)
C$ = "STRING"
CALL 13000
```

MEMORY MAP: INTEGER BASIC			
	DOS, FILES (3)	49152	\$C000
	PROGRAM	HM 38400	\$9600
HIRES		38386	\$95F2
24576 \$6000	FREE SPACE	36332	\$8DEC
16384 \$4000			
8192 \$2000	VARIABLES	2054	\$0806
	ARRAYS		
	STRINGS	LM 2048	\$0800

Figure 6: Integer BASIC map showing DOS and program.

MEMORY MAP: INTEGER BASIC			
	DOS, FILES (16)	49152	\$C000
	PROGRAM	30665	\$77C9
HIRES		HM 15000	\$3A98
24576 \$6000	FREE SPACE	14986	\$3A8A
16384 \$4000		980	\$03D4
8192 \$2000	VARIABLES	14006	\$36B6
	ARRAYS		
	STRINGS	LM 14000	\$36B0
		2048	\$0800

Figure 7: Integer BASIC map with changed LOMEM and HIMEM.

MEMORY MAP: APPLESOFT			
HIRES 24576 \$6000 16384 \$4000 8192 \$2000	DOS, FILES (3)	49152	\$C000
		HM 38400	\$9600
	FREE SPACE	36349	\$80FD
		LM 2051	\$0803
	PROGRAM	2049	\$0801
		2048	\$0800

Figure 8: Applesoft map with only the DOS in memory.

Notice in figure 9 that the variables start at LOMEM. Applesoft variables are seven bytes long. The variable area contains 14 bytes, for A and C\$. Arrays in Applesoft can be multidimensional, so they are placed in a separate location above the variables. The array space is determined by rules given in the Applesoft reference manual, pages 119 and 137. The string variable C\$ is stored in the variable area with a pointer to the word "STRING" in the string area. Note that the string area contains exactly six characters.

Something interesting happens when you put the above statements into the form of an executable program. Clear the memory, type in the program, and look at its memory map to see that the program has indeed been stored. See figure 10.

```
FP
10 A = 1
20 DIM B(10)
30 C$ = "STRING"
CALL 13000
```

Now run the program and look at it again.

```
RUN
CALL 13000
```

Figure 11 shows that the variable area still contains 14 bytes, and that array B is still the same, but there is no string in the string area. This is because the letters of the string are contained in the program area, and the pointer in C\$ obtains the string from the program.

Whenever new characters are assigned to the same string variable, they are added to the string area even if they are the same as those already assigned to that variable. A clutter of old strings thus begins to form, known as the "garbage collection." Its formation can be demonstrated by entering the same statement several times.

```
FP
A$ = "STRING"
A$ = "STRING"
A$ = "STRING"
CALL 13000
```

Notice in figure 12 that there are now 18 bytes stored in the string area, even though only six of them are being used.

MEMORY MAP: APPLESOFT			
HIRES 24576 \$6000 16384 \$4000 8192 \$2000	DOS, FILES (3)	49152	\$C000
		HM 38400	\$9600
	STRINGS	38394	\$95FA
	FREE SPACE	36267	\$80AB
		2127	\$084F
	ARRAYS	2065	\$0811
	VARIABLES	LM 2051	\$0803
	PROGRAM	2049	\$0801
		2048	\$0800

Figure 9: Applesoft map showing variable, array, and string areas.

The variable area contains seven bytes for A\$, the one variable in use.

The Applesoft reference manual makes the following statement on page 53:

"Applesoft stores duplicate strings only once. That is, if A\$ = "PIPPIN" and B\$ = "PIPPIN" then the string "PIPPIN" will be stored only once."

Let's try it and see.

```
FP
A$ = "PIPPIN"
B$ = "PIPPIN"
CALL 13000
```

Figure 13 shows that there are 12 bytes in the string area instead of only six. If you enter the monitor mode and examine the variable area you will see that the two string variables point to different locations in the string area. This obviously indicates that Applesoft does *not* store duplicate strings only once.

The actual length of a program doesn't always correspond with the amount of memory required. Just because your program is short doesn't mean you have lots of memory left over. In Applesoft it is easy to create a multidimensional array which uses up all memory space in a 48K machine.

```
FP
DIM A(97,73)
BRUN MEMORY MAP
```

Figure 14 shows that there are only 80 free bytes remaining after dimensioning the array. To verify that MEMORY MAP is indeed providing accurate information, you can check the free space remaining by using the FRE(0) command.

```
PRINT FRE(0)
80
```

If you don't need to use floating point numbers, a good way to save array space is to define the array as an integer array.

```
FP
DIM A%(97,73)
BRUN MEMORY MAP
```

MEMORY MAP: APPLESOFT			
HIRES	24576 \$6000	DOS, FILES (3)	49152 \$C000
			HM 38400 \$9600
	16384 \$4000	FREE SPACE	36314 \$800A
	8192 \$2000	PROGRAM	LM 2086 \$0826
			2049 \$0801
			2048 \$0800

Figure 10: Applesoft map showing program area.

MEMORY MAP: APPLESOFT			
HIRES	24576 \$6000	DOS, FILES (3)	49152 \$C000
			HM 38400 \$9600
	16384 \$4000	FREE SPACE	36238 \$808E
	8192 \$2000	ARRAYS	2162 \$0872
			2100 \$0834
			LM 2086 \$0826
			2049 \$0801
		VARIABLES	2048 \$0800
		PROGRAM	

Figure 11: Applesoft map after running program.



MEMORY MAP: APPLESOFT			
	DOS, FILES (3)	49152	\$C000
	STRINGS	HM 38400	\$9600
HIRES		38382	\$95EE
24576 \$6000	FREE SPACE	36324	\$8DE4
16384 \$4000			
8192 \$2000	VARIABLES	2058	\$080A
	PROGRAM	LM 2051	\$0803
		2049	\$0801
		2048	\$0800

Figure 12: Applesoft map showing formation of "garbage collection" for one string variable.

MEMORY MAP: APPLESOFT			
	DOS, FILES (3)	49152	\$C000
	STRINGS	HM 38400	\$9600
HIRES		38388	\$95F4
24576 \$6000	FREE SPACE	36323	\$8DE3
16384 \$4000			
8192 \$2000	VARIABLES	2065	\$0811
	PROGRAM	LM 2051	\$0803
		2049	\$0801
		2048	\$0800

Figure 13: Applesoft map of two string variables with duplicate strings.

(continued)

Note the large difference in space required for the array in figure 15 as compared to the preceding one. The addition of a % sign saved 21,756 bytes!

If you don't have ROM Applesoft installed, you must load Applesoft into RAM from either cassette or disk. To demonstrate, turn off the computer and remove the Applesoft card. Turn the computer back on and load Applesoft from disk by typing FP. Then run MEMORY MAP to see where RAM Applesoft is stored.

Control B  
PR#6  
FP  
BRUN MEMORY MAP

Figure 16 shows that RAM Applesoft is stored below the program area, and that it uses a large amount of space. By referring to the Hi-Res locations on the left, you can see that Hi-Res graphics' page one is not available when using RAM Applesoft.

For our final example, let's create the most complicated map possible by using RAM Applesoft, a different LOMEM and HIMEM, and all types of variables. I also tried to change MAXFILES, but it doesn't seem to work with RAM Applesoft. See figure 17.

LOMEM: 15000  
HIMEM: 20000  
A = 1  
DIM B(10)  
C\$ = "STRING"  
CALL 13000

That concludes the examples. Next month's article will contain the Memory Map program listing and will describe how it works.

Lieutenant Colonel Pete Cook is a jet pilot instructor at Williams Air Force Base. He is assigned to the Air Force's Human Resources Laboratory, Operations Training Division, a large research facility for designing advanced aircraft simulations, and one of the largest computer complexes in Arizona.

This is his third article for MICRO.

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## MEMORY MAP: APPLESOFT

		49152	\$C000
	DOS, FILES (3)		
		HM 38400	\$9600
HIRES			
24576			
\$6000			
	FREE SPACE	80	\$0050
16384			
\$4000			
8192			
\$2000			
	ARRAYS	38320	\$9580
		LM 2051	\$0803
	PROGRAM		
		2049	\$0801
		2048	\$0800

Figure 14: Applesoft map of large floating point array.

## MEMORY MAP: APPLESOFT

		49152	\$C000
	DOS, FILES (3)		
		HM 38400	\$9600
HIRES			
24576			
\$6000			
	FREE SPACE	21836	\$554C
16384			
\$4000			
8192			
\$2000			
	ARRAYS	16564	\$40B4
		LM 2051	\$0803
	PROGRAM		
		2049	\$0801
		2048	\$0800

Figure 15: Applesoft map of large integer array.

# MEMORY MAP: APPLESOFT

HIRES 24576 \$6000 16384 \$4000 8192 \$2000	DOS, FILES (3)	49152	\$C000
		HM 38400	\$9600
	FREE SPACE	26109	\$65FD
	PROGRAM	LM 12291	\$3003
		12289	\$3001
	APPLESOFT	2048	\$0800

Figure 16: Applesoft map with RAM Applesoft loaded.

# MEMORY MAP: APPLESOFT

HIRES 24576 \$6000 16384 \$4000 8192 \$2000	DOS, FILES (3)	49152	\$C000
		38400	\$9600
	STRINGS	HM 20000	\$4E20
		19994	\$4E1A
	FREE SPACE	4918	\$1336
		15076	\$3AE4
	ARRAYS	15014	\$3AA6
	VARIABLES	LM 15000	\$3A98
		12291	\$3003
	PROGRAM	12289	\$3001
	APPLESOFT	2048	\$0800

Figure 17: Applesoft map showing most complex case.



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# SYM Time-Remaining Timer

This program measures elapsed time and sounds an alarm when the preset limit is reached.

Ralph Orton  
16015 San Fernando Mission Blvd.  
Granada Hills, California 91344

Here's a neat little timer for a "barebones" 1K SYM that can satisfy a host of timing chores for you. Time phone calls, eggs, exercise sessions and contests. Don't miss TV shows, dates or appointments. My own most frequent use is to keep from "timing out" on the local amateur radio repeaters and thus I avoid the embarrassment associated with such a happening. Operating features include:

1. No peripherals required
2. Two modes of operation
3. Long timing internals (more than 4 days) with one second resolution
4. Positive status indications
5. Settable pre-time out warning
6. Ease of operation

Before entering into an explanation of timer operation, I would like to thank John Gieryic for his helpful article in the April, 1979 issue of *MICRO*; "SYM-1 6522-Based Timer." It was John's article that provided the heart of this timer.

Operation is straightforward. After entering the program, enter desired pre-time out warning (hours, minutes, seconds) and desired operating mode. These are entered sequentially in the order indicated above, starting at address "0000". For example, you have decided, as an exercise in self improvement, to restrict yourself to 10½ hours of TV per week. However, you're not crazy about the timekeeping involved

```

0800      1  ;*****
0800      2  ;*
0800      3  ;* TIME RAMAINING TIMER *
0800      4  ;*
0800      5  ;*   RALPH R. ORTON   *
0800      6  ;*
0800      7  ;*****
0800      8  ;
0800      9  ;FOR THE SYM-1
0800     10  ;SHOWS TIME REMAINING ON READOUT
0800     11  ;AND SOUNDS A SETTABLE WARNING.
0800     12  ;DISPLAYS READY WHENEVER TIMER
0800     13  ;IS STOPPED.
0800     14  ;
0800     15  ;TWO MODES OF OPERATION:
0800     16  ;"RESET" & "ACCUMULTE"
0800     17  ;
0800     18  ;LOAD TIMER INTERVAL AND WARNING
0800     19  ;TIME STARTING AT ADDRESS $0000 AS
0800     20  ;SHOWN. LOAD MODE AT $0006. PRO-
0800     21  ;GRAM STARTS AT $0200.....
0800     22  ;
0800     23  HRSSET EPZ $00          ;SET HOURS HERE
0800     24  MINSET EPZ $01          ;SET MINUTES HERE
0800     25  SECSET EPZ $02          ;SET SECONDS HERE
0800     26  HRSWAR EPZ $03          ;WARNING HOURS HERE
0800     27  MINWAR EPZ $04          ;WARNING MINUTES HERE
0800     28  SECWAR EPZ $05          ;WARNING SECONDS HERE
0800     29  MODE EPZ $06           ;"AC" = ACCUMULATE
0800     30  HRSREM EPZ $07          ;CURRENT HOURS HERE
0800     31  MINREM EPZ $08          ;CURRENT MINUTES HERE
0800     32  SECREM EPZ $09          ;CURRENT SECONDS HERE
0800     33  FRACNT EPZ $0A          ;20THS OF A SECOND ARE HERE
0800     34  DISPIN EPZ $0B          ;INPUT FOR "LODISP" SUBROUTINE
0800     35  DISPOP EPZ $0C          ;STORAGE FOR "LODISP" SUBROUTINE

0800     36  ;
0800     37  ; MONITOR SUBROUTINES:
0800     38  ;
0800     39  NIBASC EQU $8309
0800     40  INSTAT EQU $8386
0800     41  DELAY EQU $835A
0800     42  SCAND EQU $8906
0800     43  BEEP EQU $8972
0800     44  OUTDSP EQU $89C1
0800     45  ACCESS EQU $8B86
0800     46  ;
0800     47  DISBUF EQU $A640
0800     48  TV EQU $A656
0800     49  ;
0010     50  DATA ORG $0010
0010     51  ;
0010     52  BYT $50                ;R THESE ARE SEGMENT
0011     53  BYT $79                ;E CODES FOR "READY"
0012     54  BYT $77                ;A
0013     55  BYT $5E                ;D
0014     56  BYT $6E                ;Y
0015     57  BYT $00                ;SPACE
0016     58  ;
0200     59  TIME1 ORG $0200
0200 20868B 60  START JSR ACCESS
0203 F8      61  SED
0204 A900    62  RESET LDA #$00          ;INITIALIZE FRACTION
0206 850A    63  STA FRACNT          ;COUNTER
0208 A500    64  LDA HRSSET
020A 8507    65  STA HRSREM          ;TRANSFER TIME SET
020C A501    66  LDA MINSET          ;VALUES TO TIME
020E 8508    67  STA MINREM          ;COUNT LOCATIONS
0210 A502    68  LDA SECSET
0212 8509    69  STA SECREM
0214 A904    70  LDA #$04
0216 8D7902 71  STA STOMOD+1
0219 78      72  CONTIN SEI
021A A205    73  LDX #$05
021C B510    74  LODI LDA $10,X
021E 9D40A6 75  STA DISBUF,X
0221 CA      76  DEX
0222 10F8    77  BPL LODI

```

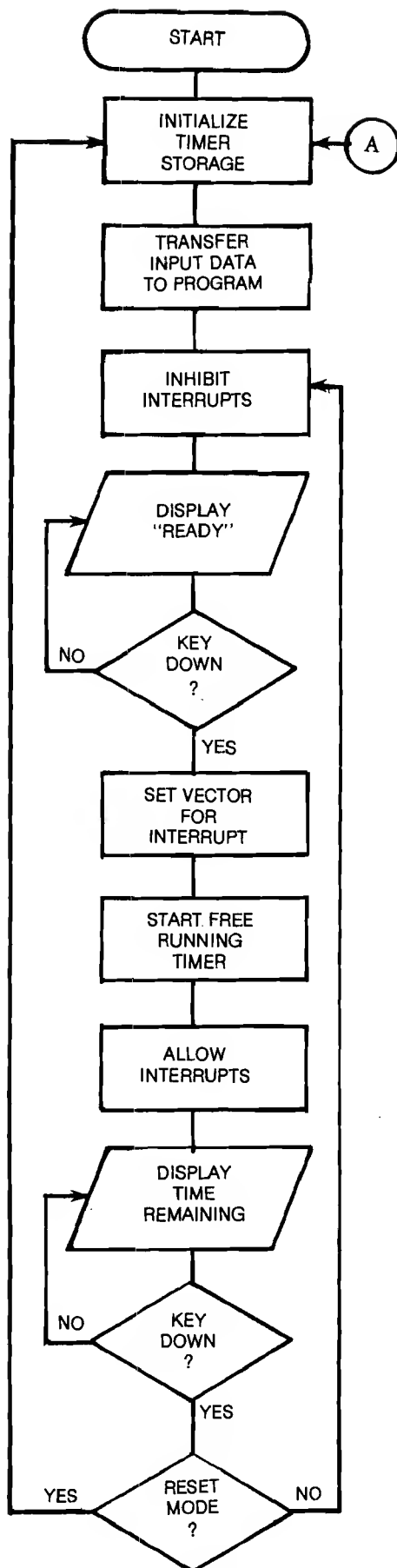


Figure 1: Main Routine

0224	200689	78	SHORDY	JSR	SCAND		;SHOW "READY"
0227	208683	79		JSR	INSTAT		;CHECK FOR KEY DOWN
022A	90F8	80		BCC	SHORDY		;IF KEY NOT DOWN, SHOW "READY"...
022C	A900	81		LDA	#S00		
022E	8D7EA6	82		STA	\$A67E		;LOAD IRQ VECTOR
0231	A903	83		LDA	#S03		;WITH ADDRESS 0300
0233	8D7FA6	84		STA	\$A67F		
0236	A9C0	85		LDA	#SC0		;LOAD IER VECTOR
0238	8D0EA0	86		STA	\$A00E		
023B	AD0DA0	87		LDA	\$A00D		;LOAD IFR REGISTER
023E	29BF	88		AND	#SBF		
0240	8D0DA0	89		STA	\$A00D		
0243	A9C0	90		LDA	#SC0		;SET TIMER FOR
0245	8D0BA0	91		STA	\$A00B		;FREE RUN MODE,
0248	A950	92		LDA	#S50		;THEN..
024A	8D06A0	93		STA	\$A006		;LOAD HIGH & LDW ORDER
024D	A9C3	94		LDA	#SC3		;COUNTER LATCHES TO
024F	8D05A0	95		STA	\$A005		;GIVE 50MS INTERRUPT
0252	58	96		CLI			
0253	A507	97	LOAD	LDA	HRSREM		;GET
0255	850B	98		STA	DISPIN		;AND
0257	206E03	99		JSR	LODISP		;LOAD
025A	A508	100		LDA	MINREM		;TIME
025C	850B	101		STA	DISPIN		;REMAINING
025E	206E03	102		JSR	LODISP		;INTO DISPLAY BUFFER
0261	A509	103		LDA	SECREM		;HRS.
0263	850B	104		STA	DISPIN		;MIN.
0265	206E03	105		JSR	LODISP		;SEC.
0268	A9AC	106		LDA	#SAC		;DETERMINE MODE SELECTED
026A	C506	107		CMP	MODE		;AND
026C	F00D	108		BEQ	SETMOD		;CHANGE IF REQUIRED.
026E	A904	109	SHOW	LDA	#S04		;DISPLAY TIME REMAINING
0270	8D56A6	110		STA	TV		;UNTIL INTERRUPTED
0273	205A83	111		JSR	DELAY		;OR KEY IS DOWN
0276	90D8	112		8CC	LOAD		
0278	4C0402	113	STOMOD	JMP	RESET		;04 MAY BE CHANGED TO 19
027B	A919	114	SETMOD	LDA	#S19		;UNDER PROGRAM CONTRL,
027D	8D7902	115		STA	STOMOD+1		;DEPENDS ON MODE.
0280	4C6E02	116		JMP	SHOW		
0283	207289	117	WARN	JSR	BEEP		;BEEPER ROUTINE
0286	207289	118		JSR	BEEP		;FOR WARNING
0289	207289	119		JSR	BEEP		
028C	207289	120		JSR	BEEP		
028F	207289	121		JSR	BEEP		
0292	60	122		RTS			
0293	207289	123	TIMOUT	JSR	BEEP		;BEEP!
0296		124					
0296	208683	125		JSR	INSTAT		;CHECK FOR KEY DOWN
0299	90F8	126		BCC	TIMOUT		;IF NO KEY DOWN, BEEP AGAIN
029B	4C0002	127		JMP	START		;IF KEY DOWN, JUMP TO START
029E		128					
029E		129					
0300		130	TIMER	ORG	\$0300		
0300	08	131		PHP			;INTERRUPT ROUTINE
0301	48	132		PHA			;STARTS HERE SO
0302	8A	133		TXA			;SAVE IMPORTANT
0303	48	134		PHA			;REGISTERS
0304	98	135		TYA			
0305	48	136		PHA			
0306	E60A	137		INC	FRACNT		;INCREMENT FRACTIONS
0308	A50A	138		LDA	FRACNT		;OF A SECOND COUNTER
030A	C914	139		CMP	#S14		;IF FULL SECOND IS
030C	F003	140		BEQ	REFRAC		;NOT UP YET JUMP TD
030E	4C6403	141		JMP	ENDINT		;END INTERRUPT ROUTINE
0311	A900	142	REFRAC	LDA	#S00		
0313	850A	143		STA	FRACNT		;AFTER RESETING FRACTION
0315	38	144		SEC			;COUNTER SUBTRACT
0316	A509	145		LDA	SECREM		;ONE SECOND FROM TIME
0318	E901	146		SBC	#S01		;REMAINING. IF NOT TIME
031A	8509	147		STA	SECREM		;TO SUBTRACT 1 MINUTE
031C	C999	148		CMP	#S99		;GOTO "CHKEND"
031E	D01A	149		BNE	CHKEND		;ROUTINE
0320	A959	150		LDA	#S59		;ONE MINUTE HAS ELAPSED
0322	8509	151		STA	SECREM		;SO RESET SECONDS TO 59
0324	38	152		SEC			
0325	A508	153		LDA	MINREM		;SUBTRACT 1 MINUTE
0327	E901	154		SBC	#S01		;TIME REMAINING
0329	8508	155		STA	MINREM		;IF NOT TIME TO SUBTRACT
032B	C999	156		CMP	#S99		;ONE HOUR....
032D	D00B	157		BNE	CHKEND		;GOTO "CHKEND" ROUTINE
032F	A959	158		LDA	#S59		;ONE HOUR HAS ELAPSED
0331	8508	159		STA	MINREM		;SO RESET MINUTES TO 59
0333	38	160		SEC			
0334	A507	161		LDA	HRSREM		
0336	E901	162		SBC	#S01		;SUBTRACT 1 HOUR FROM
0338	8507	163		STA	HRSREM		;TIME REMAINING
033A	A507	164	CHKEND	LDA	HRSREM		;IF HRS., MIN. AND
033C	C900	165		CMP	#S00		;SEC. ARE ALL ZERO
033E	D00F	166		BNE	CHECK		;THEN TIMER HAS TIMED OUT
0340	A508	167		LDA	MINREM		
0342	C900	168		CMP	#S00		
0344	D009	169		BNE	CHECK		;IF NO TIME OUT
0346	A509	170		LDA	SECREM		;HAS OCCURRED GO TO
0348	C900	171		CMP	#S00		;CHECK AND DETERMINE
034A	D003	172		BNE	CHECK		;IF TIME FOR WARNING
034C	4C9302	173		JMP	TIMOUT		;IS TO BE SOUNDED
034F	A505	174	CHECK	LDA	SECWAR		;COMPARE WARNING HR/MIN/SEC



0351	C509	175	CMP	SECRET		;TO TIME REMAINING HR/MIN/SEC
0353	D00F	176	BNE	ENDINT		;IF NOT A MATCH, GOTO
0355	A504	177	LDA	MINWAR		;END INTERRUPT ROUTINE
0357	C508	178	CMP	MINREM		
0359	D009	179	BNE	ENDINT		
035B	A503	180	LDA	HRSWAR		
035D	C507	181	CMP	HRSREM		
035F	D003	182	BNE	ENDINT		
0361	20B302	183	JSR	WARN		;SOUND A WARNING
0364	AD04A0	184	ENDINT	LDA	SA004	;RESET TIMER INTERRUPT FLAG
0367	68	185	PLA			;RESTORE
0368	A8	186	TAY			;ALL
0369	68	187	PLA			;PREVIOUSLY
036A	AA	188	TAX			;SAVED
036B	68	189	PLA			;REGISTERS
036C	28	190	PLP			;AND
036D	40	191	RTI			;RETURN FROM INTERRUPT...
036E	A50B	192	LODISP	LDA	DISPIN	;GET DIGITS TO BE
0370	850C	193		STA	DISPOP	;DISPLAYED AND SAVE
0372	6A	194	ROR			;FOR LATER RECALL.
0373	6A	195	ROR			;POSITION MSD FOR CONVERSION
0374	6A	196	ROR			;TO ASCII
0375	6A	197	ROR			
0376	200983	198	JSR	NIBASC		
0379	20C189	199	JSR	OUTDSP		;LOAD DIGIT
037C	A50C	200	LDA	DISPOP		;GET OTHER DIGIT AND CONVERT
037E	200983	201	JSR	NIBASC		;TO ASCII....
0381	20C189	202	JSR	OUTDSP		;THEN LOAD DIGIT
0384	60	203	RTS			;RETURN FROM SUBROUTINE....

in such an effort. So, you guessed it, here comes the SYM Timer. Starting at address "0000" you punch in "10" "30" "00". Then to provide a one-hour warning you continue with "01" "00" "00". At this point you are ready to select mode of operation.

By entering "AC" you will select the "Accumulative" mode of operation. In this mode you can "start" and "stop" the timer as often as required. The timer will continue timing at each "start" from where it was last stopped. If you had entered anything other than "AC" you would have selected the "Resettable" mode of operation. In this mode each "start" causes the timer to begin again from the original timer interval you set.

With a simple "Go" "200" "CR" SYM displays "ready". To start the timer press any key and time remaining is displayed. To stop the timer once more press any key and "ready" is displayed again.

When the timer reaches the pre-time out warning the beeper will sound momentarily, and when time out occurs, the beeper will sound continuously until it is reset by pressing any key.

Well that's it—maybe! I keep fighting off the urge to toss in more and more. For instance, how about a 1 year timer that reads out "Hrs x 100" "Hrs." "Min."? Or if that's a little ridiculous, then maybe one that displays "days" "hrs." "min." for in excess of 3 months of timing. Then of course we could have an option to display elapsed time as well as time remaining. I don't suppose it would be too difficult to toss in a 24 hour clock while we're at it. Of course it would have to operate simultaneously with all the other options.

So on and on it goes. For now, however, I will leave it to others to perfect the *ultimate* time machine.

**MICRO**

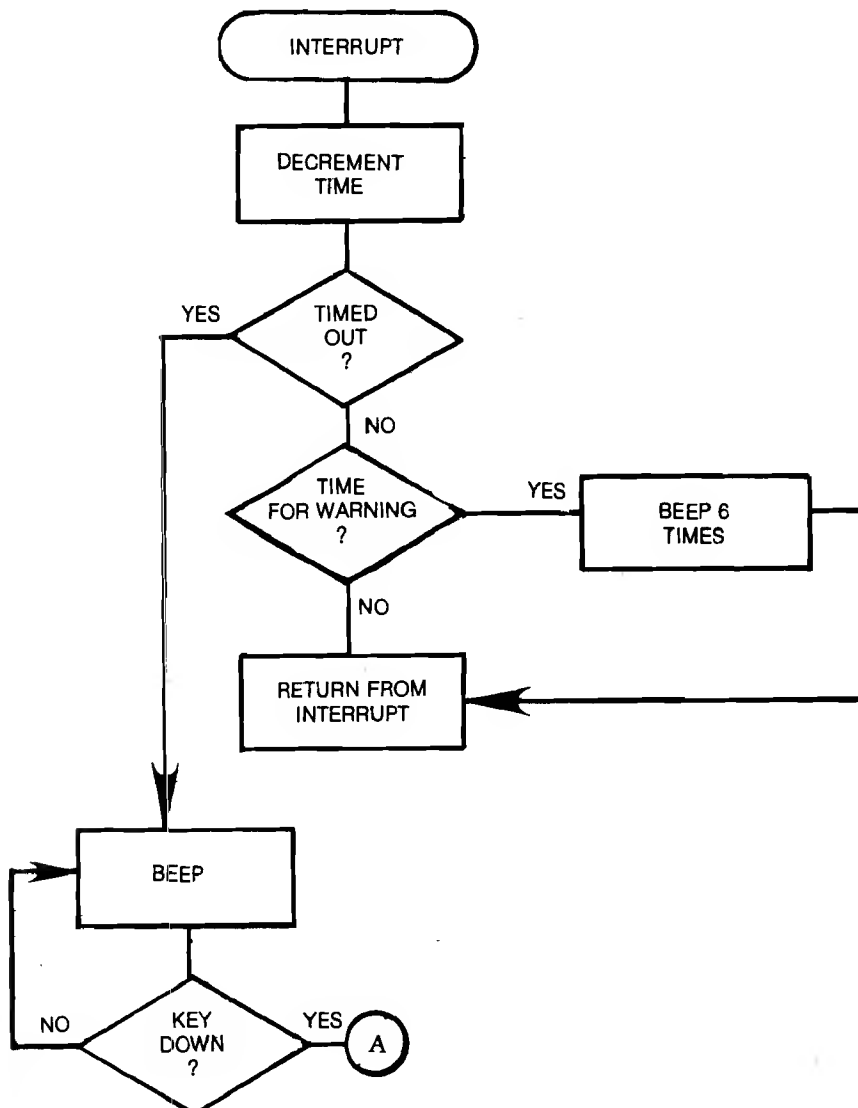


Figure 2: Interrupt Routine

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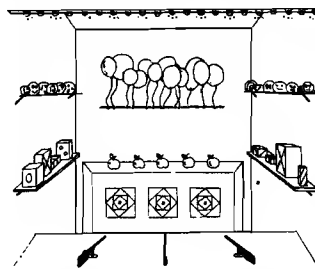
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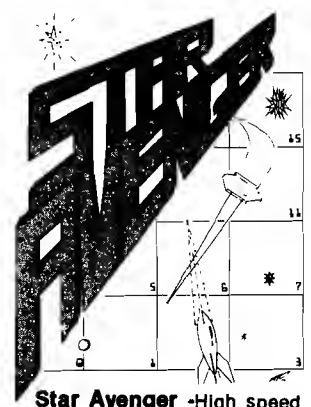
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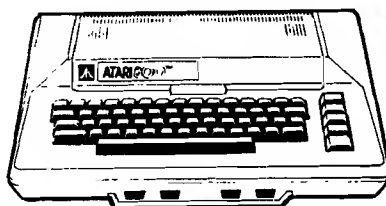
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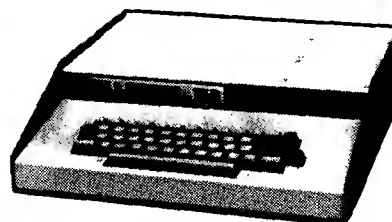
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# Oh No — It's Garbage Collect!

**This article describes Garbage Collect in Microsoft's 6502 BASIC. The worst case is described, and a few suggestions made on how to avoid it.**

Gordon A. Campbell  
36 Doubletree Road  
Willowdale, Ontario  
M2J 3Z4

I was really pleased! The simple text editor worked well. It even had a fancy quasi-INPUT routine, just like CURSOR. And it only took a couple of days to develop, since it was written entirely in BASIC. Now to get on with some articles.

The first opus went well. After several input sessions, I ran a full draft. All the changes were going well, when suddenly, right in the middle of entering a command, the PET went dead. Pushing the STOP key did nothing, so I sat back to consider my sins. After a minute, the cursor returned, and the editor was again working.

The light came on. I was the victim of the dreaded garbage collect.

Garbage collect is the compression of string space. In Microsoft's 6502 BASIC, string contents are placed at the top of memory, working down. When a string is assigned a new value, it is placed below all previous strings. At some point, memory is filled, so garbage collect squishes all the strings back up to the top. It may also be forced, by using FRE(0).

The following one-liner provides the basis for some experiments:

```
5 N = 1000:  
B$ = CHR$(1):  
DIM A$(N):
```

```
FOR J = 0 TO N:  
A$(J) = B$:  
NEXT:  
A$(0) = "B":  
T = TI:  
PRINT FRE(0) TI-T
```

The program sets up bunches of strings, changes the first one, and forces garbage collect while printing the time required. (The CHR\$ is required since assigning a string a literal value results in the string pointer pointing at the literal in the program, rather than use of string space.)

Changing N showed that the number of strings has a roughly exponential effect on the time required. Changing the size of B\$ showed that the number of characters in the strings has no apparent effect on the time.

To find the worst case, some swift calculation shows that N can be set to 7908, and garbage collect takes 84 minutes and 13 seconds. But we can go higher. Drop the start-of-BASIC down to the first cassette buffer, and raise the top-of-memory to the end of the screen. Now N can be set to 8261, for a time of 91 minutes and 56 seconds!

How about other machines? A call to a friend showed that Applesoft is compatible with the PET. The only difference is the 10% that the PET spends looking at the keyboard and cassettes, and updating the clock. Down at our neighborhood Radio Shack we found that string space must be reserved with a 'CLEAR n' command. There is no apparent time spent in garbage collect, but there is a value for the CLEAR command which seems to crash the system, so that may be it. Presumably the Atari with its fixed-length strings doesn't create garbage in the first place.

Published information indicates that the latest PET ROM-set does garbage collect much more quickly. In a classic trade-off of speed versus memory, it also takes two bytes more

per string. The ways to reduce garbage collect are fairly obvious: don't have more strings than are absolutely required. For example:

1. Re-use work variables.
2. Use numbers rather than strings for switches.
3. Put literals right into PRINT statements rather than use constant strings.
4. Try to create the most stable strings first.
5. Avoid loops which create a string by concatenating a character at a time onto the string.
6. Apply the usual techniques to keeping your program small.
7. Avoid sorting techniques which involve changing the actual contents of the array. Instead, use QUICKSORT, or an Assembler sort which changes the string pointers.

Garbage collect will happen in any case. In interactive programs without a large number of strings, it can be made invisible to the operator by forcing it (X = FRE(0)) during times when the operator doesn't expect to use the keyboard. For 'batch' programs, the least amount of time will be consumed by just letting it happen when it must.

In summary, the next time your PET (Apple, SYM) seems to crash, don't reset it right away. It may just be collecting its garbage.

After 15 years in main-frame data processing, Gordon Campbell purchased a cassette-based PET in the spring of 1979. Since then, the PET has grown a disk, printer, and modem. The latest expansion provides CB2 sound in stereo.

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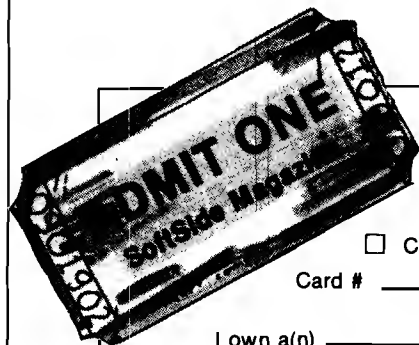
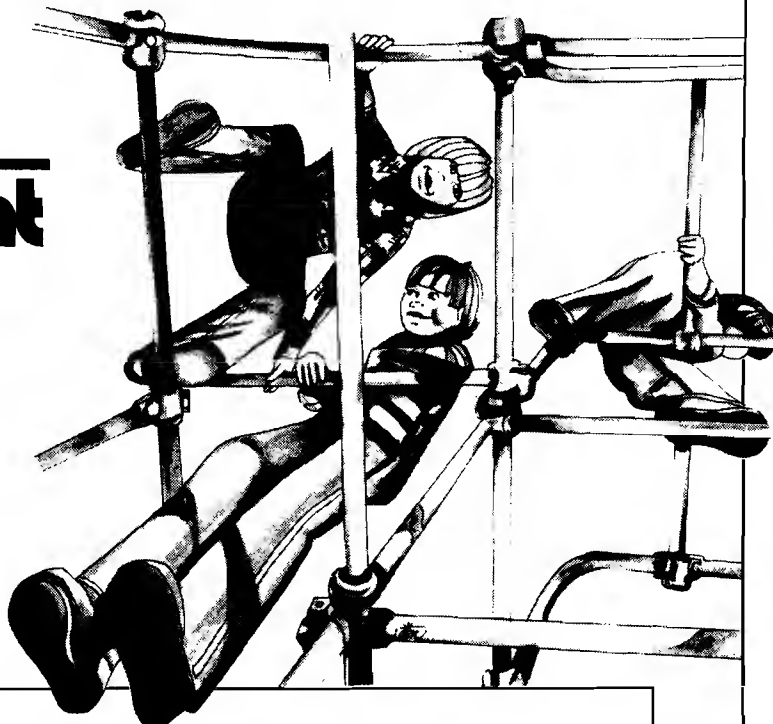
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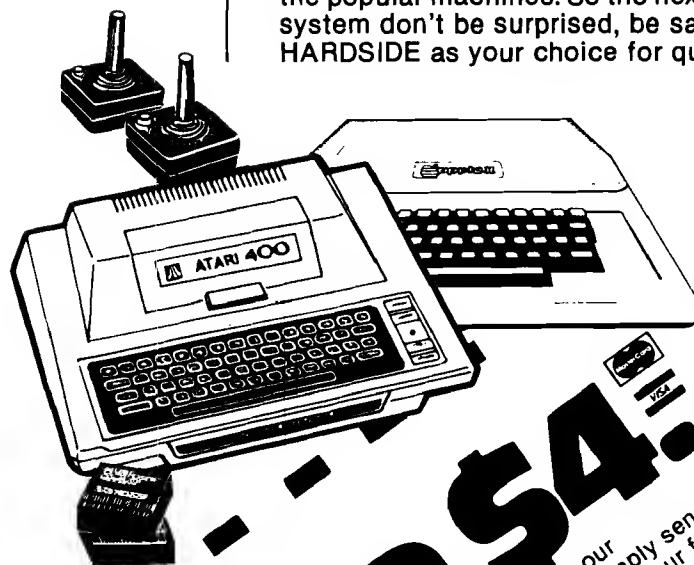
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WAPR81



# An AIM 65 Intelligence Test

Please answer each question:

- 1 Who has been offering complete 6502-based products since 1976?  
☐ Rockwell International    ☐ The Computerist
- 2 Who makes a video expansion board for the AIM 65 that fully supports the AIM Monitor, Editor, Assembler and BASIC?  
☐ Rockwell International    ☐ The Computerist
- 3 Who offers a memory expansion board for the AIM with 32K RAM, provision for up to 16K EPROM, and an EPROM programmer using VIA chips?  
☐ Rockwell International    ☐ The Computerist
- 4 Who offers an enclosure for the AIM 65?  
☐ Rockwell International    ☐ The Computerist
- 5 Which company has supplied a one-year warranty on all of its AIM 65 products?  
☐ Rockwell International    ☐ The Computerist
- 6 Who will be offering a controller board for the AIM 65 that includes a multi-purpose controller, RS232 asynchronous communication interface, and a demo program in the second quarter of 1981?  
☐ Rockwell International    ☐ The Computerist
- 7 Who consistently uses a cost-effective integrated approach in the development of AIM-oriented products?  
☐ Rockwell International    ☐ The Computerist

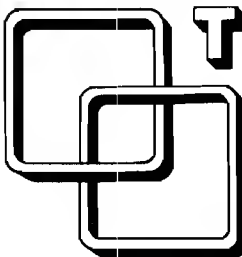
Answers:

1. The Computerist started offering complete AIM 65 products in 1976.
  2. The Computerist Video Expansion Board supports all screen formats, EPROMs, and BASIC. It is the only major AIM firmware that currently offers any warranty.
  3. The Computerist offers a memory expansion board for 2716, 2532, and 2708 EPROMs. It provides similar capabilities with Rockwell's 2708 EPROM/ROM module (\$175.), PROM Programmer (\$175.), and the Adapter/Buffer Module (\$175.). The total cost is \$1440.00.
  4. The Computerist offers AIM Plus — an enclosure with built-in power supply and video expansion board. The power supply is rated at +5V at 5A and +12V at 0.5A. Rockwell's power supply alone, no enclosure, with a +5V at 5A and +12V at 0.5A, for \$150.00.
  5. The Computerist products carry a limited one-year warranty. Rockwell's products carry a 90-day warranty.
  6. The Computerist will offer a new multi-purpose controller board in the second quarter of 1981, which will include floppy disk, RS232, and other controllers on one board. Rockwell has not announced such a product.
  7. The Computerist uses the integrated approach of efficiently combining a number of functions on a single board in a very price-effective way. Rockwell followed that approach very well in the AIM 65, but has totally abandoned the integrated approach in favor of expansion modules.
- 8 Now, where are you going to look for support for your AIM 65?  
☐ Rockwell International    ☐ The Computerist

**Answer:** If you answered "The Computerist" to question 8, then you pass the AIM Intelligence Test. So send for our 1981 Product Guide. If you answered "Rockwell International", then maybe you didn't understand the question.

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# MICRO

## New Publications

Mike Rowe  
New Publications  
P.O. Box 6502  
Chelmsford, MA 01824

This column lists new publications received for review and also reports on pertinent publication announcements received from book and periodical publishers.

### General 6502

**The 6502 Instruction Handbook** by Scelbi Publications (20 Hurlbut Street, Elmwood, Connecticut 06110), 1981, 44 pages, 3¼ × 8½ inches, paperbound. \$4.95

Designed as a shirt-pocket guide for programmers, technicians, and engineers. Portions of the publication appeared originally in *SCELBI's 6502 Software Gourmet Guide & Cookbook* (by Robert Findley, 1979). This slim reference work, available from computer stores or for an extra 50¢ from the publisher, contains a synopsis of each instruction set for the 6502 CPU. Mnemonics and machine codes in hexadecimal format are provided for each addressing mode. Appendices list the instruction set alphabetically by assembler mnemonics as well as numerically by machine code. Other information provided includes a hexadecimal-to-decimal conversion chart, a chip pinout diagram, timing data, and diagrams of chip architecture.

**6502 Games** by Rodney Zaks. 6502 Series, Volume IV, Sybex Inc. (2344 Sixth Street, Berkeley, California 94710), 1980, x, 292 pages, 50 figures, 5½ × 8½ inches, paperbound. ISBN: 0-89588-023-9 \$12.95

This book is designed as an educational text for the programmer who wants to learn advanced programming techniques by using the 6502. Although it can be used merely to play games with a 6502-based board, for educational purposes, the reader should be familiar both with the 6502 instruction set and with basic programming techniques. The programs listed are for the SYM but can be adapted to other 6502-based microcomputers.

**CONTENTS:** *Introduction*—The Games Board. *Music Player*—Play a sequence of up to 255 notes (13 different notes) and record it automatically. *Translate*—The computer displays a binary number. Each player in turn must press the hexadecimal equivalent as quickly as possible. The first to score 10 wins. Designed for two players. *Hexguess*—Guess a 2-digit hex number generated by the computer. The computer will tell you how far off your guess is. You are allowed up to 10 guesses. *Magic Square*—Light up a perfect square on the board. Each key inverts some LED pattern. Skill and logic are required. *Spinner*—A light is spinning around a square. You must catch it by hitting the corresponding key. Every time you succeed, it will spin faster. A game of skill. *Slot Machine*—A Las Vegas type slot machine is simulated, with three spinning wheels. Try your luck. *Echo*—Recognize and duplicate a sound/light sequence (also known as SIMON—A manufacturer trademark). *Mindbender*—Play against the dealer (the computer) with a deck of 10 cards. You may hit or stay. Don't bust! *Blackjack*—Guess a sequence of numbers generated by the computer. It will tell you how many digits are correct and in the right position (also known as MASTERMIND—a manufacturer trademark). *Tic-Tac-Toe*—Try to achieve three in a row before the computer does in this favorite game of strategy. The computer's ability improves with yours. Can you outsmart it? *Appendices:* A. 6502 Instructions—Alphabetic; B. 6502—Instruction Set: Hex and Timing. *Index.*

### AIM 65

**AIM 65 Laboratory Manual and Study Guide** by Leo J. Scanlon. John Wiley & Sons (605 Third Avenue, New York, New York 10158) 1981, 180 pages, diagrams and charts, 8½ × 11 inches, paperbound. ISBN: 0-471-06488-2 \$7.95

A study and exercise book designed to introduce students to microcomputers by working with the AIM 65. Pages are perforated so that the student's answers, written in the book, can be handed in, lesson by lesson, for review by the instructor. The author, employed by Rockwell International, the manufacturer of the AIM 65, provides 32 pages of answers to the experiments.

**CONTENTS:** Getting to Know the AIM 65; Addition Operations; Subtraction and Logical Operations; Program Sequencing; Debugging Programs; Multiplication Operations, with Shift & Rotate; Division Operations; Subroutines and the Stack; Unordered Lists; Sorting Unordered Data; Code Conversion from Input; Code Conversion for Output; Input/Output; A More Powerful I/O Device, the R6522 VIA; Interrupts; A Timing Program with Decimal Output; The AIM 65 Assembler; Answers to Experiments.

### General Microcomputer

**The Personal Computer Book** by Robin Bradbeer. Input Two-Nine, an imprint of MCB Publications Limited (198/200 Keighley Road, Bradford, West Yorkshire, England BD9 4JQ), 1980, 220 pages, illustrated, 8¼ × 5-6/8 inches, paperbound.

ISBN: 0-905897-56-0 U.S. \$15.00;  
£5.25

An introductory work on microcomputers, written especially for readers in the United Kingdom.

**CONTENTS:** *What's It All About?*—The computer can assist us tremendously, both in business and pleasure; How is it possible?; The first hobby computer; Who buys personal computers?; What do you use the computer for?; Developments in the next few years. *Where Do I Start?*—Ten hints to help you on your way. *The Computer—What Is It? How Does It Work?*—The computer—confusingly versatile; How the computer works, in simple terms; Binary numbers; How does the computer handle binary numbers?; The processor—the CPU—from the inside; The computer's own road network—the bus; Storage inside the computer. *How Do I Talk to the Computer?*—Machine Language; Assembly language; High-level languages; At which level do I begin?; BASIC—a convenient language; Firmware; Software; Which microprocessor is best? *What's In the Boxes?*; Input devices; Keyboard-based input; Speech recognition; Direct Input; Storage media; Cassette storage; Disk storage; Other storage media; Output devices; Video output; Printed output; Electric typewriter/TTY; Matrix printers; Daisy wheel printer; Other printers; Speech synthesis. *What Can I Buy?*—The Computer system; Personal computer equipment survey; Part 1, Section A—*Single board computers*; Kit-built systems; Training systems, Part 1, Section B—*Desk top systems*. Part 1, Section C—*Bus-based systems*—S100 Bus. Part 1, Section D—*Other Buses*—SS 50, Non-standard. Input/Output devices, memory storage media; other media; Part 2—*Printers*. Part 3—*Video display units*. Part 4—*Other peripherals*. How do I choose a system? *What Can I Do With It?*—Games; Education; Business use; Word processing; Information handling; Controlling things; Making money; Examples of personal computers in use. *Appendices:* A. Binary Arithmetic; Octal; Hexadecimal; ASCII Code. B. Bus Standards; S100 (IEEE); SS50, etc. C. Manufacturers and Distributors in U.K. D. Computer Clubs in the U.K. E. Magazines in English... UK/USA/Continent. F. Bibliography of Selected Microcomputer Books. G. Glossary. H. Some Hints on Kit-build Systems.

(Continued on following page)

**The Carl Helmers Personal Computer Letter** is a monthly newsletter which began publication with the January 1981 issue. Helmers, a co-founder of *Byte* magazine and its former Editorial Director, provides subscribers with analyses of issues and trends affecting the small computer industry. Helmers plans to offer subscribers the opportunity to participate in a monthly Personal Computer Industry Conference Call which he will moderate. Each issue is a minimum of 8 pages; some may run to 24 or 48 pages. A one-year subscription is \$200.00 from North American Technology, Inc., 174 Concord Street, Suite 23, Peterborough, New Hampshire 03458.

### Microcomputers and Business

**Basic Business Software** by E.G. Brooner. Blacksburg Continuing Education Series, Howard W. Sams & Co., Inc. (4300 West 62nd Street, Indianapolis, Indiana 46268), 1980, 142 pages, charts, diagrams, and listings, 5½ x 8½ inches, paperbound. ISBN: 0-672-21751-1 \$9.95

This book is designed primarily for business people who want to understand some of the fundamentals of business software development. But it is also for programmers who want to learn more about business software. Some familiarity with BASIC-language programming is assumed. The author aims to teach readers either to write some of their own business software or evaluate programs written by others. Sample programs are included.

**CONTENTS:** *Introduction to Small-Business Software*—Objectives; Small-Business Computers Defined; Effect on Paper Work; Businesses that Benefit; Software Costs; Self-Help Test Questions. *Software Fundamentals*—Objectives; Software Functions; Computer Languages; The Operating System; Software Defined; Language-Independent Programming; BASIC Comparison and Translation; Self-Help Test Questions; References. *How To Choose Appropriate Business Software*—Objectives; Practical Limits; Where To Get It; When Customizing Is Needed; Compatibility; Self-Help Questions. *How Programs Are Put Together*—Objectives; Terms Defined; The Use of Symbols in Programming; The Step-by-Step Method; Subroutines, or Modules; Programming Hints; Summary of the Step-by-Step Method; Debugging Hints and Other Techniques; The Disk Subsystem; Self-Help Test Questions. *Information Storage and Retrieval*—Objectives; Data Generation and Storage; How Data Is Stored; Disk Handling; The Disk Library; File Structure; Overview of "CHECKING"

Program; Sorting Computer Data; Program Analysis; "NAMELIST"; Self-Help Test Questions; References. *Inventory Control*—Objectives; Who Needs an Inventory?; Inventory as a List; Inventory Functions; Program Analysis; Program Evaluation; Rapid Search Methods; Summary; Self-Help Test Questions; Reference. *Payroll Programs*—Objectives; Payroll Requirements; Printing on Prepared Forms; Program Development; The Master File; Master Payroll Program; Entering Employee Data; Payroll Entries and Calculations; Entering Pay Data; Pay Procedure; Payroll Summary; Conclusion; Self-Help Test Questions; Test Programming Project. *General Ledger Programs*—Objectives; Terms Defined; General Ledger Defined; System Overview; Transaction Examples; Program Descriptions; Operating the General Ledger System; Self-Help Test Questions; Test Project. *An Introduction to Word Processing*—Objectives; Word-Processing Functions; Office of the Future; Hardware Requirements; Suitable Software; Time Sharing. *Basic Computer Modeling and Simulation*—Objectives; The Break-Even Example; Graphical Method; The Computer Technique; Other Simulation Problems; Random Numbers; Self-Help Test Questions; References. *Appendix*—ASCII Code Chart; Glossary; Index.

**Small Computers for the Small Businessman** by Nicholas Rosa and Sharon Rosa, dilithium Press (30 N.W. 23rd Place, Portland, Oregon 97210), 1980, x, 332 pages, 5½ x 8-5/16 inches, paperbound. ISBN: 0-918398-31-2 \$12.95

This book is written for *small business* people and is mostly about small computers, specifically microcomputers. It is intended to help the reader select the computer that best meets his business needs.

**CONTENTS:** *The Small Computer Revolution*—But we're not trying to sell you; "The price of a new car"; Then why shouldn't you wait?; Now, about that rash idea...; Affording it; Turnkey in the store; Graphics; How "big" a system; Making money directly; "But I'm not a computer freak..."; That mini- and micro- distinction; What about just renting services?; Now whaddaya mean, "Revolution?"; The integrated circuit; But what's a semiconductor?; Large scale integration; And suddenly—; Voila!; The significance. *The Small Business Computer*—Interfacing; Memories are made of this...; A final memory; Mass storage; The other stuff. *This Thing Called Software*—Documentation; Programs; Computer languages; Those translating programs; What BASIC looks like; Enough, already; Now, about that problem...; Acquiring the stuff. *Data Processing and Word Processing*—The nature of data processing; The nature of word processing; Choosing a system. *How to Shape Your*

*Computer System*—Getting into it; Using the consultant; Finding the consultant; Finding the vendor; Getting it all in writing; Involving your staff; The happy outcome. *Buying Services Instead*—Service bureaus; Timesharing; Whither timesharing? Amen, amen. *The Minicomputer*—But anyway; Acquisition notes; Again, what's a mini?; Making a decision; The cloudy crystal ball; The onrushing dawn. *Shopping for Your Hardware*—How much to buy?; The double system; System in one cabinet? Memory options; Where to buy; Guarantees; Notes on I/O devices; Keyboards; Writehandler™; Teleprinters, Teletype™, Electric typewriters; CRT display; Other displays; Cassette drive; Floppy disks, diskettes; Hard disks; Winchester; Printers; Isolators, noise suppressors; Power supplies; Front panel; Modems; The computer room; "Desk tops" and accessories; Cost and quality; Watch out. *The Professions and the Computer*—The accountant; The law office; The doctor's office; The writer's office; That bottom line (financing); Leasing; Tax benefits. *The Butcher, The Baker and The Candlestick jobber*—The small manufacturer; Construction and lumber; Warehouses; Real estate; Insurance; A portrait studio; Pharmacy; Restaurant; Finding out more. *Glossary. Appendix*—How It All Works. *Index.*

### General Computer

**Software News — The Computer Software Products Newspaper** is a newspaper tabloid which will appear monthly beginning in May. Sentry Database Publishing, a division of Technical Publishing, will issue the tabloid [Technical Publishing is the publisher of *Datamation* and is owned by The Dun & Bradstreet Corporation]. *Software News* will report on the software industry. It will provide analysis and commentary on applications packages, systems software, productivity aids, databases, and language processors. It will cover data and software security, software legal issues, and job opportunities; and it will offer user ratings and surveys, software vendor profiles, market statistics, and other business and financial information. The newspaper will be distributed to 50,000 software buyers and specifiers. For information, write Software News, 5 Kane Industrial Drive, Hudson, Massachusetts 01749.

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# MICRO

## Dealers

*Presented here in zip-code order are those MICRO dealers who responded to our newsletter request for information concerning their dealership. Many have been MICRO dealers for quite some time while others are new. This service is provided to acquaint readers with these dealers and to encourage readers to visit dealers in their area. This listing is provided twice a year to update previous listings (see MICRO 29:69). This is not intended as a complete listing of MICRO dealers.*

### United States

#### Maine

Maine Micro Systems Inc.  
555 Center Street  
Auburn, Maine 04256  
Contact: Hugh Blair/Al Celetti  
207/782-7139

Hardware: Aim, Apple, Atari, CBM, KIM, PET, TRS-80  
Software: Educational, Personal, Business, Games  
Publications: MICRO, Compute, Kilobaud, 80-Microcomputing

#### Vermont

Computers Plus  
177 Church St.  
Burlington, Vermont 05401  
Contact: Tim Barden  
802/658-5858

Hardware: Apple, Atari, HP-85  
Software: Educational, Personal, Business, Games, General Accounting  
Publications: MICRO, Byte, Creative Computing, Microcomputing

#### Connecticut

The Computer Store  
63 South Main St.  
Windsor Locks, Connecticut 06096  
Contact: Susan Bramley  
203/627-0188  
Hardware: Apple, HP-85  
Software: Educational, Personal, Business, Games  
Publications: MICRO, Byte, Nibble, Creative Computing

Southbury Professional Systems Inc.  
D.B.A. The Micro-Computer Store  
Unlon Square  
Southbury, Connecticut 06488  
Contact: Marilyn or Joseph Osterman  
203/264-2983

Hardware: Apple, Atari, Vector Graphic

Software: Educational, Personal, Business, Games, Professional

#### New Jersey

Software City  
111 Grand Ave.  
River Edge, New Jersey 07661

#### New York

Time Enterprise  
8247 Genesee Road  
Springville, New York 14141  
Contact: Paul Zielinski  
716/592-7665  
Hardware: OSI  
Software: For OSI

#### Pennsylvania

Computer Mail Order  
501 E. Third St.  
Williamsport, Pennsylvania 17701  
Contact: Randy Gallit  
717/323-7921

Hardware: Atari, CBM, PET  
Software: Educational, Personal, Business, Games

#### Maryland

Computer Crossroads, Inc.  
9143 G Red Branch Road  
Columbia, Maryland 21045  
Contact: Richard Simpson  
301/730-5513

Hardware: Apple, Atari  
Software: Educational, Personal, Business, Games  
Publications: Many

#### Virginia

Computerland of Tysons Corner  
8411 Old Courthouse Road  
Vienna, Virginia 22180  
Contact: Rich Doud  
703/893-0424

Hardware: Apple, Atari, CBM, PET, North Star, Dynabyte, T.I., Cromemco  
Software: Educational, Personal, Business, Games, Languages, Utilities, etc.  
Publications: MICRO, Byte, Kilobaud, Personal Computing, Creative Computing, Nibble

Computer Center  
2927 Virginia Beach Blvd.  
Virginia Beach, Virginia 23452  
Contact: Jeff Wilson  
804/340-1977  
Hardware: Apple, Atari

Software: Educational, Personal, Business, Games  
Publications: MICRO, Byte, Creative Computing, Interface, Call-APPLE

#### North Carolina

ETC Corporation  
P.O. Box G - OLD NC 42  
Apex, North Carolina 27502  
Contact: Jeff Butler  
919/362-4200  
Hardware: AIM, CBM, KIM, OSI, PET, Billings  
Software: Educational, Personal, Business, Games, Scientific, Custom  
Publications: MICRO, Byte, Microcomputing, Compute

#### Florida

Associated Information Systems  
825 Osceola Drive  
Rockledge, Florida 32955  
Contact: D.R. Hendricks  
305/632-1090  
Hardware: OSI  
Software: Educational, Personal, Business, Games, Custom Programming  
Publications: MICRO

AMF Microcomputer Center, Inc.  
11158 N. 30th St.  
Tampa, Florida 33612  
Hardware: Apple  
Software: Educational, Personal, Business, Games  
Publications: All major computer magazines

#### Ohio

Microage Computer Store  
2591 Hamilton Road  
Columbus, Ohio 43227  
Contact: John W. Spencer  
616/868-1550  
Hardware: Apple, Atari, North Star, HP, TI, Archives, Altos, Ithica, Zenith  
Software: Educational, Personal, Business, Games  
Publications: All

#### Michigan

New Dimensions in Computing, Inc.  
541 E. Grand River  
East Lansing, Michigan 48823  
Contact: Robert Gibbs  
517/337-2880  
Hardware: Atari, Exidx, Vector Graphic, Intersystems  
Software: Educational, Personal, Business, Games  
Publications: MICRO, Byte, Interface Age, Microcomputing, 80-Microcomputing, Compute, Creative Computing

## Wisconsin

Byte Shop of Milwaukee  
6019 W. Layton Avenue  
Greenfield, Wisconsin 53220  
Contact: Kathleen Preston  
414/281-7004  
Hardware: Apple, CBM, PET, North Star, APF  
Software: Educational, Personal, Business, Games  
Publications: MICRO, 68 Micro, Byte, Creative, Kilobaud, 80 Micro-computing, onComputing, Interface Age, Nibble, Apple Orchard, Compute, Softside, Personal Computing, etc.

PETTED micro systems  
4265 W. Loomis Rd.  
(P.O. Box 21851)  
Milwaukee, Wisconsin 53221  
(moving soon)  
Contact: Theodore J. Polczynski  
414/282-4181  
Hardware: Atari, CBM, KIM, PET,  
Software: Educational, Personal, Business, Games, TRS-80 Instant software and creative computing  
Publications: MICRO, Compute, Kilobaud, Creative Computing

## Minnesota

Personal Business Systems  
4306 Upton Ave. So.  
Minneapolis, Minnesota 55410  
Contact: Mike Carlson  
612/929-4120  
Hardware: Apple  
Software: Educational, Personal, Business, Games  
Publications: MICRO, Apple Orchard, Creative Computing, Peelings, Nibble

## Illinois

Data Domain of Schaumburg  
1612 E. Algonquin Rd.  
Schaumburg, Illinois 60195  
Contact: Marilyn Clark, Steve Shendelman  
312/397-8700  
Hardware: Apple, Alpha Micro, Hewlett-Packard Calculators and Accessories  
Software: Educational, Personal, Business, Games  
Publications: Large selection

Farnsworth Computer Center  
1891 N. Farnsworth Ave.  
Aurora, Illinois 60505  
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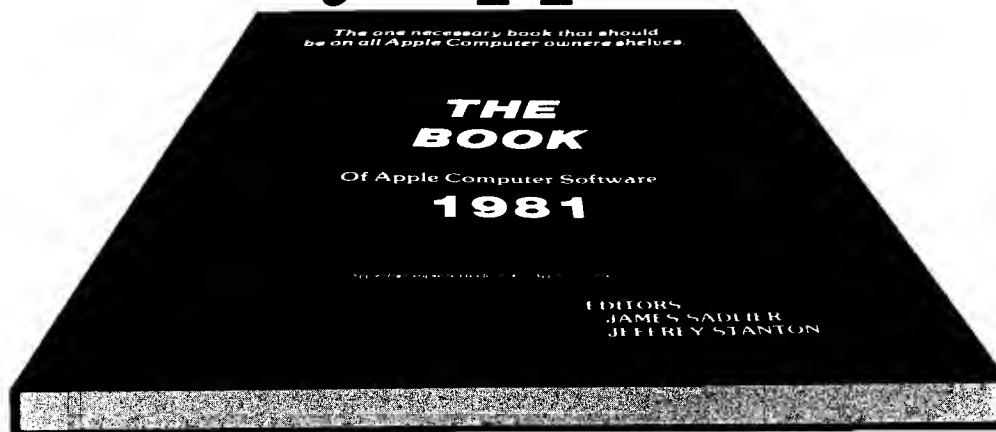
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# MICRO

## PET Vet

By Loren Wright

### Numbering of BASIC Versions

There seems to be a bit of confusion on the numberings of BASIC versions. One popular numbering system for the BASICs is the one I have been following: 2.0, 3.0, and 4.0. However, the one used by Commodore is a little different. The original BASIC (the "old" ROM's) is called 1.0. The "upgrade" version, produced until recently, is 2.0, and now we have 4.0. I will use the latter convention from now on, and will edit manuscripts published in MICRO accordingly.

All 80-column machines have 4.0 ROMs, as do recent production 40-column machines. These new 40-column machines are called 4016 and 4032, but the actual circuit board is still the same. Some of the enclosures have plastic tops, apparently enlarged to accommodate a disk drive. The disk drive idea doesn't seem to have caught on, but I expect we'll be seeing more and more plastic tops. Also, boards continue to be delivered with holes drilled in the traces of 4016 PC boards where the second row of RAM chips would go. This is to prevent users or unscrupulous dealers from making a cheap and easy memory upgrade.

There is an upgrade kit to go from 2.0 to 4.0 BASIC, and you could even go from 24-pin 1.0 ROMs to 4.0 if you had another socket to install the eighth chip. As far as I know, there is no 28-pin (6540) upgrade kit.

There are several good reasons to upgrade—faster garbage collection and more powerful disk commands, for instance. All but the most serious programmers will stay with what they have. After all, the old ROMs weren't so bad were they?

### Toward Universal PET Programs

MICRO will continue to publish articles for all three BASIC ROM sets, and for both disk operating systems, but as I mentioned in a previous column, articles that apply to all three are much preferred.

I call your attention to "PRINT USING for the PET" by David Malmberg in this issue. Not only has he reworked an excellent Apple program for the PET, but he has also accommodated all three PET ROM sets. This involved knowing the right page-zero locations and system calls for each ROM set. These are available from the memory maps and entry point lists published by Jim Butterfield in *Compute* and *The Transactor*. Malmberg also uses the contents of 50003 to identify which BASIC is being used: 0—1.0; 1—2.0; 160—4.0. Because the numbers involved are easy to remember, this is fast becoming a standard technique. Some other frequently-used locations that vary from BASIC to BASIC are given in table 1.

Page zero locations tend to be the same in BASIC 2.0 and 4.0, but in 1.0 they are completely different. PET system calls have different addresses, but generally they work similarly in each BASIC. Malmberg's BASIC program will run on any PET or CBM machine without modification.

### 80-Column Functions

The 80-column function table that appeared in last month's column contained some errors. The corrected version, with a couple of additions, is shown in table 2.

The window feature on the 80-column machines can be very powerful. It confines user input (and the computer's attention) to a restricted area of the screen. The SET TOP and SET BOTTOM commands fix the upper left and lower right corners of the window. The window may also be defined by POKEing four values into memory for the four edges:

	Address	Range
TOP	224	0 to 24
BOTTOM	225	TOP to 24
LEFT	226	0 to 79
RIGHT	213	LEFT to 79

The window may be cleared by printing or striking on the keyboard two successive HOMEs.

Table 1

	1.0	2.0	4.0
1) End of memory pointer	134,135	52,53	52,53
2) # characters in keyboard buffer	525	158	158
3) Disable STOP key POKE	537,136	144,49	144,88
4) Enable STOP key POKE	537,133	144,46	144,85

Table 2

Function	ASCII	Reverse Field Character	Keyboard Combination
BELL	7	g	
DELETE LINE	21	u	ESC, RVS, K
ERASE to BEGINNING of line	150	V	LS, ←, 3
ERASE to END of line	22	v	←, Q, 4
GRAPHICS screen	142	N	LS, RS
INSERT line	149	U	SH, ESC, RVS, K
SCROLL DOWN	153	Y	LS, ESC, K
SCROLL UP	25	y	
SET BOTTOM	143	O	SH, Z, A, L
SET TOP	15	o	Z, A, L
SET TAB/CLEAR TAB	137	I	SH, TAB
TAB	9	i	TAB
TEXT screen	14	n	

SH = either shift

LS = left shift

RS = right shift

All digits are on the numeric keypad, not the main keyboard.

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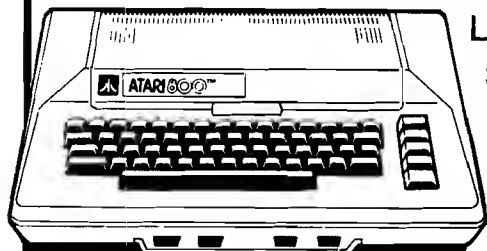
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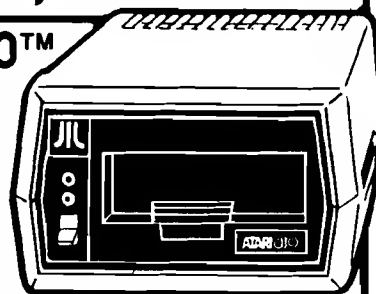


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# Add a Light Pen to your Micro

This article includes the hardware details necessary to install a light pen on any 6502 system. Software is included for an OSI Implementation.

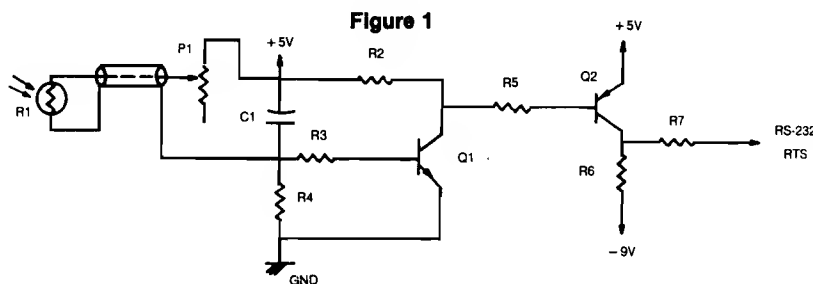
Peter Alan Koski  
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Many computer installations today offer alternate forms of user I/O other than the standard CRT/keyboard combination. Among these is the light pen. In using a light pen, the user, if choosing from a menu for example, simply points the pen at what he desires. When locating a point on a grid, the user simply locates the point using the pen, rather than inputting coordinates through the keyboard.

Although the user may find this simplification of input fabulous, for the programmer there exists a lot of overhead. The programmer must keep track of where the information is located on the screen as the program progresses, and how the information changes during program execution.

## Principles of Operation

In theory, the operation of a light pen is extremely straightforward. When a request is made to locate the pen, a distinguishable token is swept across the display until the pen recognizes its presence. At that time, if we know where the token is, we also know where the pen is. Simple as this may seem, the hardware and software doesn't always follow suit on simplicity. On graphics systems where there is often a stand-alone microprocessor to control the terminal functions, the "token" is the raster sweep. This is



## Bill of Materials

R1 — photo-resistor (see text)  
R2 — 1.8K  
R3 — 18K  
R4 — 120K  
R5 — 10K  
R6 — 470  
R7 — 470  
Q1 — 2N5300 (RS 276-2009)  
Q2 — 2N5226 (RS 276-2032)  
C1 — .005 uF  
P1 — 100K PC-type potentiometer

Table 1

0 D000	1 D008	2 D010	3 D018	4 D020	5 D028	6 D030	7 D038
8 D100	9 D108	10 D110	11 D118	12 D120	13 D128	14 D130	15 D138
16 D200	17 D208	18 D210	19 D218	20 D220	21 D228	22 D230	23 D238
24 D300	25 D308	26 D310	27 D318	28 D320	29 D328	30 D330	31 D338
32 D400	33 D408	34 D410	35 D418	36 D420	37 D428	38 D430	39 D438
40 D500	41 D508	42 D510	43 D518	44 D520	45 D528	46 D530	47 D538
48 D600	49 D608	50 D610	51 D618	52 D620	53 D628	54 D630	55 D638
56 D700	57 D708	58 D710	59 D718	60 D720	61 D728	62 D730	63 D738



probably the most sophisticated and elegant approach since the resolution is extremely high and the scan is invisible to the user.

I have taken a much more simplified approach. Rather than search the entire screen for the pen's location, I request verification at given screen locations. With this approach, the token must be displayed on the screen in order for the pen to see it. Since the standard scan rate for a monitor is 1/60 second, we have to display the token and then wait the required 1/60 second to guarantee that the token reaches the display. Obviously if we were to poll 2048 display locations, the time required wouldn't make this practical.

## Hardware

Figure 1 and the accompanying "bill of materials" presents the design for the light pen circuit I am using. The sensor used is a small Calectro photo-resistor mounted in a magic marker casing. The choice of the photo-resistor over a photo-transistor was based on spectrum sensitivity. Photo-transistors that I found were not responsive to a phosphorus source. The photo-resistor was, so the choice was obvious.

The light/dark conditions are reflected via an RS-232 line which is toggled between +5 and -9 volts. RS-232 was chosen as the communications link since I have an RS-232 port on my machine (as do most). By using the light pen to drive the RTS line on the port, I can monitor the status of the pen by monitoring the status word of the ACIA. The pen's condition will be found at the RTS bit.

The circuit goes together nicely on a small piece of perf-board. The interconnecting line used is a piece of miniature shielded micro-phone cable. There shouldn't be any problem assembling the circuit and all that remains is to adjust the light pen to match the CRT used.

A BASIC routine can be used to initially align the pen. While printing the contents of the status port, adjust the monitor's brightness/contrast and P1 of the light pen circuit. A point should be found so that touching the pen to an illuminated position will cause the RTS bit to be set low ("0"), a dark position should set the RTS bit high ("1"). It should be possible to find a position which is comparable to normal viewing intensity.

```

0800      1  ;*****
0800      2  ;*
0800      3  ;* LIGHT PEN QUADRANT QUERY *
0800      4  ;*          ROUTINE          *
0800      5  ;*
0800      6  ;*          PETER A. KOSKI    *
0800      7  ;*
0800      8  ;*****
0800      9  ;
0800     10  ;
3280     11          ORG $3280
3280     12  PENWRD EQU $FC00
3280 206C33 13          JSR GETBLK
3283     14  ;
3283     15  ;GET USR ARGUMENT (QUADRANT NUMBER) -- INSU
RE
3283     16  ;THAT THE VALUE IS ONLY 0 - 63
3283     17  ;
3283 A5B2 18          LDA $B2
3285 293F 19          AND #$00111111
3287 A8    20          TAY                      ;GET ADDR LOOKUP
OFFSET
3288     21  ;
3288     22  ;LOAD BASE ADDRESS INTO STORE/BLANK/SCAN/RE
STR
3288     23  ;ROUTINES
3288     24  ;
3288 B9BA33 25          LDA LOADDR,Y
3288 8DBB32 26          STA STORE+1
328E 8DC332 27          STA BLANK+1
3291 8D0233 28          STA SCRNI+1
3294 8D3D33 29          STA RESTRE+1
3297     30  ;
3297 B97A33 31          LDA HIADDR,Y
329A 8DBC32 32          STA STORE+2
329D 8DC432 33          STA BLANK+2
32A0 8D0333 34          STA SCRNI+2
32A3 8D3E33 35          STA RESTRE+2
32A6     36  ;
32A6     37  ;INITIALIZE ADDRESSES FOR SAVE BUFFER
32A6     38  ;BUFFER STARTS AT $337E
32A6     39  ;
32A6 A97A    40          LDA #$7A
32A8 8DBE32 41          STA SCRNI+1
32AB 8D3A33 42          STA SCRNI+1
32AE A933    43          LDA #$33
32B0 8DBF32 44          STA SCRNI+2
32B3 8D3B33 45          STA SCRNI+2
32B6     46  ;
32B6     47  ;SAVE BLOCK DATA/BLANK (DARKEN) SELECTED
32B6     48  ;QUADRANT
32B6     49  ;
32B6 A000    50          LDY #00
32B8 A200    51          SAVE LDX #00
32BA BDFFFF 52          STORE LDA $FFFF,X
32BD 8DFFFF 53          SCRNI STA $FFFF                      ;SAVE CHAR IN BU
FFER
32C0 A920    54          LDA #$20
32C2 9DFFFF 55          BLANK STA $FFFF,X
32C5 EEBE32 56          INC SCRNI+1
32C8 D003    57          BNE NOCRY1
32CA EEBF32 58          INC SCRNI+2
32CD E8      59          NOCRY1 INX
32CE E008    60          CPX #08                      ;8 CHAR/LINE/QUA
D
32D0 D0E8    61          BNE STORE
32D2 C8      62          INY
32D3 C004    63          CPY #04                      ;4 LINE/QUAD
32D5 F01A    64          BEQ OUT1
32D7 ADBB32 65          LDA STORE+1
32DA 18      66          CLC
32DB 6940    67          ADC #$40
32DD 8DBB32 68          STA STORE+1
32E0 8DC332 69          STA BLANK+1
32E3 ADBC32 70          LDA STORE+2
32E6 6900    71          ADC #00
32E8 8DBC32 72          STA STORE+2
32EB 8DC432 73          STA BLANK+2                      ;GET NEXT LINE A
DDR
32EE 4CB832 74          JMP SAVE
32F1     75  ;

```

## Software

The two routines presented here are essentially identical except for the resulting resolution. Both are called via the BASIC USR function. The longer of the two routines accepts argument values from 0-63, the number corresponding to the screen quadrant to be queried. Table 1 shows the quadrant numbering scheme. The address associated with each quadrant is the address of the upper left memory location in the quadrant. Quadrants run eight locations horizontally and four locations vertically, or 32 locations total. Thus, touching the pen to any of these locations will score a hit. A hit is returned to BASIC as a 1 from the USR function, a miss is returned as a 0. This routine is thus most useful when resolution is not critical, such as for menu selection.

The single-cell query routine polls individual memory locations and thus provides  $64 \times 32$  resolution. The argument of the USR function should be the requested memory address, less 32768. (BASIC only allows signed 15-bit arguments.) The return value is the same as the previous: 1 if hit, 0 if miss.

Both routines use the same idea in polling the requested position. The information at the quadrant or single cell is first saved and replaced by OSI graphics character \$20 [blank]. If the pen is presently looking at a dark location, we *might* have its position. If not, we replace the data and return a miss. Should the pen be dark, we replace the \$20 with \$A1 [full illumination character]. At this point, if the pen sees a transition to light, we are at the correct position and return a hit after restoring the data. Had the transition not been seen by the pen, we obviously were not at the right location, and would return a miss.

## Programming with a Light Pen

When using the light pen, screen locations become very critical, thus careful formatting should be used through the memory map supplied by OSI. Remember that when using standard input and print statements, the screen has a tendency to scroll. Fortunately, this can be avoided by disabling the line feed. POKE 9644,42 will disable the scroll, POKE 9644,98 will re-enable the scroll routine.

(continued on page 63)

```

32F1      76 ;SEE IF LIGHT PEN WENT DARK
32F1      77 ;
32F1 206F33 78 OUT1 JSR TVDLA ;1/60 S. SCAN DE
LAY
32F4      79 ;
32F4 AD00FC 80 LDA PENWRD
32F7 2908 81 AND #$00001000
32F9 F037 82 BEQ NOTFND ;DARK PEN SETS R
TS
32FB      83 ;
32FB      84 ;PEN IS DARK/ENABLE QUADRANT AND SEE IF
32FB      85 ;PEN SEES CHANGE
32FB      86 ;
32FB A000 87 LDY #00
32FD A200 88 ENABLE LDX #00
32FF A9A1 89 LDA #$A1 ;WHITE SQUARE CH
AR.
3301 9DFFFF 90 SCRNI STA $FFFF,X
3304 E8 91 INX
3305 E408 92 CPX $08
3307 D0F8 93 BNE SCRNI
3309 C8 94 INY
330A C004 95 CPY #04
330C F014 96 BEQ OUT2 ;ENTIRE QUAD ENA
BLED
330E AD0233 97 LDA SCRNI+1
3311 18 98 CLC
3312 6940 99 ADC #$40
3314 8D0233 100 STA SCRNI+1
3317 AD0333 101 LDA SCRNI+2
331A 6900 102 ADC #00
331C 8D0333 103 STA SCRNI+2
331F 4CFD32 104 JMP ENABLE ;ADDR OF NEXT LI
NE
3322      105 ;
3322      106 ;CHECK TO SEE IF PEN SEES ENABLED QUADRANT
3322      107 ;
3322 206F33 108 OUT2 JSR TVDLA ;1/60 S. SCAN DE
LAY
3325      109 ;
3325 AD00FC 110 LDA PENWRD
3328 2908 111 AND #$00001000
332A D006 112 BNE NOTFND ;HI PEN DISABLES
RTS
332C      113 ;
332C      114 ;RETURN CODE FOR PEN:
332C      115 ;1 TO BASIC = PEN WAS IN QUADRANT
332C      116 ;0 TO BASIC = PEN WAS NOT IN QUAD
332C      117 ;
332C A901 118 LDA #01
332E 48 119 PHA ;SAVE RETURN COD
E ON STACK
332F 4C3533 120 JMP REPLCE
3332      121 ;
3332 A900 122 NOTFND LDA #00
3334 48 123 PHA ;SAVE RETURN COD
E ON STACK
3335      124 ;
3335      125 ;RESTORE ORIGINAL DATA FOUND AT QUADRANT
3335      126 ;
3335 A000 127 REPLCE LDY #00
3337 A200 128 RPLCE LDX #00
3339 ADFFFF 129 SCRNI LDA $FFFF
333C 9DFFFF 130 RESTRE STA $FFFF,X
333F EE3A33 131 INC SCRNI+1
3342 D003 132 BNE NOCRY2
3344 EE3B33 133 INC SCRNI+2
3347 E8 134 NOCRY2 INX
3348 E008 135 CPX #08
334A D0ED 136 BNE SCRNI
334C C8 137 INY
334D C004 138 CPY #04
334F F014 139 BEQ OUT3
3351 AD3D33 140 LDA RESTRE+1
3354 18 141 CLC
3355 6940 142 ADC #$40
3357 8D3D33 143 STA RESTRE+1
335A AD3E33 144 LDA RESTRE+2
335D 6900 145 ADC #00

```

# MICRO

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### (Add a Light Pen...)

335F 8D3E33	146	STA RESTRE+2	
3362 4C3733	147	JMP RPLCE	
3365	148		
3365	149	;RETURN TO BASIC CALLING ROUTINE	
3365	150		
3365 68	151	OUT3 PLA	;POP RETURN CODE
3366 A8	152	TAY	
3367 A900	153	LDA #00	
3369 6C0800	154	JMP (08)	RTS
336C	155		
336C 6C0600	156	GETBLK JMP (06)	
336F	157		
336F	158	;TV SCAN DELAY	
336F	159		
336F A040	160	TVDLA LDY #\$40	
3371 A2FF	161	LOOP1 LDX #\$FF	
3373 CA	162	LOOP2 DEX	
3374 D0FD	163	BNE LOOP2	
3376 88	164	DEY	
3377 D0F8	165	BNE LOOP1	
3379 60	166	RTS	
337A	167		
337A	168	;QUADRANT CHARACTER HOLD BUFFER	
337A	169		
337A	170	BUFFER EQU *+32	
337A	171		
337A	172	;ADDRESS LOOK UP TABLE FOR 64 GIVEN QUADRANT	
337A	173		
337A D0D0D0	174	HIADDR HEX D0D0D0D0D0D0D0D0	
337D D0D0D0			
3380 D0D0			
3382 D1D1D1	175	HEX D1D1D1D1D1D1D1D1	
3385 D1D1D1			
3388 D1D1			
338A D2D2D2	176	HEX D2D2D2D2D2D2D2D2	
338D D2D2D2			
3390 D2D2			
3392 D3D3D3	177	HEX D3D3D3D3D3D3D3D3	
3395 D3D3D3			
3398 D3D3			
339A D4D4D4	178	HEX D4D4D4D4D4D4D4D4	
339D D4D4D4			
33A0 D4D4			
33A2 D5D5D5	179	HEX D5D5D5D5D5D5D5D5	
33A5 D5D5D5			
33A8 D5D5			
33AA D6D6D6	180	HEX D6D6D6D6D6D6D6D6	
33AD D6D6D6			
33B0 D6D6			
33B2 D7D7D7	181	HEX D7D7D7D7D7D7D7D7	
33B5 D7D7D7			
33B8 D7D7			
33BA	182		
33BA 000810	183	LOADDR HEX 0008101820283038	
33BD 182028			
33C0 3038			
33C2 000810	184	HEX 0008101820283038	
33C5 182028			
33C8 3038			
33CA 000810	185	HEX 0008101820283038	
33CD 182028			
33D0 3038			
33D2 000810	186	HEX 0008101820283038	
33D5 182028			
33D8 3038			
33DA 000810	187	HEX 0008101820283038	
33DD 182028			
33E0 3038			
33E2 000810	188	HEX 0008101820283038	
33E5 182028			
33E8 3038			
33EA 000810	189	HEX 0008101820283038	
33ED 182028			
33F0 3038			
33F2 000810	190	HEX 0008101820283038	
33F5 182028			
33F8 3038			

```

0800      1  ;*****
0800      2  ;*
0800      3  ;* SINGLE VIDEO CELL QUERY *
0800      4  ;* ROUTINE *
0800      5  ;*
0800      6  ;* PETER A KOSKI *
0800      7  ;*
0800      8  ;*****
0800      9  ;
3280     10  ORG $3280
3280     11  OBJ $800
3280     12  PENWRD EQU $FC00
3280 20C432 13  JSR GETBLK
3283     14  ;
3283     15  ; TURN USR ARGUMENT INTO 6502 ADDRESS
3283     16  ;
3283 A5B2 17  LDA $B2
3285 48   18  PHA
3286 A5B1 19  LDA $B1
3288 0980 20  ORA #$10000000
328A 85B2 21  STA $B2
328C 68   22  PLA
328D 85B1 23  STA $B1
328F     24  ;
328F A200 25  LDX #00
3291     26  ;
3291     27  ;SAVE CHARACTER AT CELL AND DARKEN
3291     28  ;SELECTED CELL
3291     29  ;
3291 A1B1 30  LDA ($B1,X)
3293 48   31  PHA ;SAVE CHAR ON ST
ACK
3294 A920 32  LDA #$20
3296 81B1 33  STA ($B1,X)
3298     34  ;
3298     35  ;SEE IF LIGHT PEN WENT DARK
3298     36  ;
3298 20C732 37  JSR TVDLA ;1/60 S. SCAN DE
LAY
329B AD00FC 38  LDA PENWRD
329E 2908 39  AND #$00001000
32A0 F018 40  BEQ NOTFND ;DARK PEN SETS R
TS
32A2     41  ;
32A2     42  ;PEN IS DARK / ENABLE CELL AND CHECK IF
32A2     43  ;PEN SEES TRANSITION
32A2     44  ;
32A2 A9A1 45  LDA #$A1 ;WHITE SQUARE CH
AR.
32A4 81B1 46  STA ($B1,X)
32A6     47  ;
32A6     48  ;CHECK TO SEE IF PEN SAW ENABLED CELL
32A6     49  ;
32A6 20C732 50  JSR TVDLA ;1/60 S. SCAN DE
LAY
32A9     51  ;
32A9 AD00FC 52  LDA PENWRD
32AC 2908 53  AND #$00001000
32AE D00A 54  BNE NOTFND ;HI PEN DISABLES
RTS
32B0     55  ;
32B0     56  ;RETURN CODE FOR PEN:
32B0     57  ;1==PEN WAS AT CELL
32B0     58  ;0==PEN WAS NOT AT CELL
32B0     59  ;
32B0 68   60  PLA ;GET CELL'S CHAR
ACTER
32B1 81B1 61  STA ($B1,X)
32B3 A900 62  LDA #00
32B5 A001 63  LDY #01
32B7 6C0800 64  JMP (08)
32BA     65  ;RTS -- BASIC
32BA     66  ;
32BA 68   67  NOTFND PLA ;GET CELL'S CHAR
ACTER
32BB 81B1 68  STA ($B1,X)
32BD A900 69  LDA #00
32BF A000 70  LDY #00
32C1 6C0800 71  JMP (08)
32C4     72  ;RTS -- BASIC

```

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### (Add a Light Pen...)

```
32C4          73 ;
32C4 6C0600   74 GETBLK JMP (06)
32C7          75 ;
32C7          76 ;DELAY TO ALLOW FOR STANDARD TV SCAN
32C7          77 ;
32C7 A000     78 TVDLA LDY #00
32C9 A200     79 LOOP1 LDX #00
32CB E8       80 LOOP2 INX
32CC D0FD     81 BNE LOOP2
32CE C8       82 INY
32CF C040     83 CPY #$40
32D1 D0F6     84 BNE LOOP1
32D3 60       85 RTS
```

```
950 REM *****
952 REM *
954 REM * LIGHT PEN DEMONSTRATION *
956 REM * BY PETER A KOSKI *
958 REM *
960 REM *****
1004 REM CALL IN SCREEN CLEAR ROUTINE
1005 REM
1006 DISK!"CALL 3280=31,3"
1010 POKE 574,128: POKE 575.50
1020 X=USR(X)
1021 REM
1022 REM LOAD SELECTION DATA ONTO SCREEN
1023 REM
1030 PRINT " == ELEMENTARY MATH LIGHT PEN DEMO =="

1040 PRINT : PRINT : PRINT
1050 PRINT " 0 1 2 3 4 5 6 7
8";
1060 PRINT " 9"
1070 PRINT : PRINT : PRINT : PRINT
1080 PRINT " + - * /"
1090 PRINT : PRINT : PRINT : PRINT . PRINT
2000 REM
2010 REM RUN THE PROGRAM USING SUBROUTINES
2020 REM
2021 REM CALL IN SINGLE CELL QUERY ROUTINE
2022 REM
2025 DISK!"CALL 3280=31,2":RPT=0
2030 GOSUB 3000:A1=NUM
2040 GOSUB 4000:O=OP:RPT=RPT+1
2050 GOSUB 3000:A2=NUM
2060 ON O GOTO 2100,2200,2300,2400
2100 ANS=A1+A2
2110 GOTO 2500
2200 ANS=A1-A2
2210 GOTO 2500
2300 ANS=A1*A2
2310 GOTO 2500
2400 ANS=A1/A2
2500 REM
2510 REM PRINT OUTPUT
2520 REM
2530 POKE 9644,42: REM DISABLE SCROLL ON PRINT
2600 PRINT " THE RESULT IS ";ANS
2605 FOR PS=1 TO 200:PS=ABS(PS):NEXT PS
2620 PRINT "
2625 IF RPT=5 THEN 5000
2630 GOTO 2030
3000 REM
3010 REM NUMERIC INPUT (SINGLE DIGITS)
3020 REM
3025 NUM=0:CNT=0
3030 FOR CELL=54402 TO 54458 STEP 6
```

```

3040 NUM=USR(CELL-32768)
3050 IF NUM=1 THEN NUM=CNT: RETURN
3060 CNT=CNT+1
3100 NEXT CELL
3110 CNT=0
3120 GOTO 3030
4000 REM
4010 REM   OPERATOR INPUT
4020 REM
4025 CNT=1
4030 FOR CELL=54730 TO 54760 STEP 10
4040 OP=USR(CELL-32768)
4045 IF OP=1 THEN OP=CNT: RETURN
4046 CNT=CNT+1
4050 NEXT CELL
4100 GOTO 4025
5000 REM
5010 REM   ANOTHER 5 ROUNDS ?
5020 REM
5021 REM   CALL IN SCREEN CLEAR
5022 REM
5030 DISK!"CALL 3280=31,3
5040 X=USR(X)
5045 REM
5046 REM CALL IN QUADRANT QUERY ROUTINE
5047 REM
5050 DISK!"CALL 3280=31,1
5060 POKE 9644,98: REM RE-ENABLE SCROLL
5065 REM
5066 REM   DISPLAY QUESTION/INPUT SELECTION
5067 REM
5070 PRINT "   WOULD YOU LIKE ANOTHER GO AT IT ?"
5080 PRINT : PRINT : PRINT : PRINT
5090 PRINT "           YES                      NO"
5100 PRINT : PRINT
5110 IF USR(49)=1 THEN 950
5120 IF USR(52)=1 THEN 6000
5130 GOTO 5110
6000 REM
6010 REM   EXIT TO BASIC
6020 REM
6030 DISK!"CALL 3280=31,3
6040 X=USR(X)
6050 END

```

Other thoughts to keep in mind, especially if taking input from a graph, is that the pen can move only to a block adjacent to the one where it is presently. Thus, once the original position is known, the next move can only be one of, at most, eight positions. The accompanying demonstration program should help to explain. The two routines and a screen clear are on track 31 in this example, and are all called into \$3280 for execution. The quadrant routine is on sector 1, the individual cell routine on sector 2, and the screen clear code on sector 3. The program is a simple arithmetic demo. Single-digit arguments and operators are input via the light pen and the result is printed to the screen without line feed. After five repetitions, the program asks the user if he would like another session. Again, the yes/no response is accepted through the light pen.

### Conclusion

Although the routines presented were written for an OSI mini-floppy system, any 6502 system supporting memory mapped video should be able to employ them. The only changes to be made are the addresses of the display block and of the ACIA.

One last thought for disk owners—a menu or display block which is repeatedly used at various points of the program may be held resident on a disk track and then CALLED to \$D000. As you'll discover, speed plays an important part in light pen I/O, since the time spent for input is nil. The processing and output must therefore be as streamlined as possible in developing an efficient system.

**MICRO**

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# Integer BASIC Internals

**Here's a sorted list of Apple Integer BASIC memory locations and routines, with some examples of how to use them.**

Glenn R. Sogge  
P.O. Box 203  
Evanston, Illinois 60204

Apple Computer Co. has released to its dealers a set of application and information notes that are quite informative. Included in the package is a listing of memory locations and routines used by Integer BASIC. The table with this article is a numerically sorted (by hex address) listing of this information. Also included are the corresponding decimal equivalents of the addresses and a little information about the routines. In general, routines without descriptions are the handlers for the functions named.

Hardly any information is given about how the routines are called or are used but with a little digging I'm sure you can figure out how to use at least a few of these in your own programs. At least, you now know where to begin looking. For example, the routine at \$E51B ("HEX/DEC") converts the

16-bit number contained in the X (lo) and A (hi) registers to a decimal number from 0-65535 and prints it out.

The routine at \$EE68 prints out the "RANGE ERR" message and the routine at \$E36B prints out the "MEM FULL ERR" message. A couple of useful tricks are also mentioned in the Apple material.

1. To find the absolute address of a given line, place the line number (in hex) into locations \$CE-\$CF (lo and hi). Then jump to address \$E56D (\*E56DG); the absolute address will be returned in locations \$E4-\$E5 (lo and hi).

2. To execute a GOTO from the monitor, put the absolute address of the line (found by the above procedure) into \$C6-\$C7 and put a negative byte into the mode location (eg., \$80 into \$D9—a negative value indicates run mode, a positive one indicates immediate mode). Then jump to \$E867 (\*E867G) and you will be back in BASIC running at that line.

This item was picked up from a bulletin board here in Chicago and is from Mark Pump.

"If you've ever accidentally pressed RESET while an Integer BASIC program was running, this is for you. In the monitor, enter:

\*E3E3G

and the statement number which was last executed is displayed. Press RESET again and re-enter DOS with \*3D0G. This method can also be used to find the statement number of an outstanding Integer BASIC input statement. When the input prompt occurs, press RESET and \*E3E3G to find the statement number. Exiting the program with control-C will not show the statement number if an input statement was active."

You should also notice that there seems to be some discrepancy between the list of page zero locations used given in the list and the chart on page 75 of the new Apple II Reference Manual (the white book). According to the chart, locations \$E0-\$FF are not used by Integer BASIC but the detailed list shows this to be incorrect. Some of those locations are indeed used by BASIC! Also, some locations are used for a couple of things, depending on the routine in command, so the values might not always be what you would expect.

SYN REPORT FOR REGS:0	NAME	DESCR	00CE	206	ACL	GEN'L ACC LO
HEX	DEC		00CE	206	VALGETL	PRIMARY EVAL TEMP LO
004A	74	LOMEML	00CE-00CF	206-207	VAL	16-BIT TEMP FOR MATH
004B	75	LOMEMH	00CF	207	VALGETH	PRIMARY EVAL TEMP HI
004C	76	HIMEML	00CF	207	ACH	GEN'L ACC HI
004D	77	HIMEMH	00D0	208	SROHL	PTR FOR SEARCH VAR TBL LO
004E	78	RNDL	00D1	209	SROHH	PTR FOR SEARCH VAR TBL HI
004F	79	RNDH	00D1-00F0	209-240	TOKNDXSTK	TOKEN INDEX STACK
0050-006F	80-111	NOUNSTKL	00D2	210	SROH2L	VAR TAB SEARCH PTR2 LO
0058-0077	88-119	SYNSTKH	00D3	211	SROH2H	VAR TAB SEARCH PTR2 HI
0078-0097	120-151	NOUNSTKH	00D4	212	IFSKIP	IF ? THEN FAIL FLAG
0080-009F	128-159	SYNSTKL	00D5	213	ORFLAG	CARR RTN FLAG
00A0-00BF	160-191	NOUNSTKC	00D6	214	VERBNOW	CURR VERB IN USE
00A8-00C7	168-199	TXNDXSTK	00D7	215	PRINOW	PRINT IT NOW FLAG
00C8	200	TXINDX	00D8	216	YSAVE	TEMP FOR X-REG
00C8	200	OUTVAL	00D9	217	RUNMODE	RUN MODE FLAG
00C9	201	YTEMP	00DA	218	AUXL	AUX CNTR LO
00CA	202	LEADBL	00DB	219	AUXH	AUX CNTR HI
00CB	203	PPL	00DC	220	PRL	CURR LN VAL LO
00CC	204	PPH	00DD	221	PRH	CURR LN VAL HI
00CD	205	PVL	00DE	222	PNL	CURR NOUN PTR LO
00CD	205	PVH	00DF	223	PNH	CURR NOUN PTR HI

(continued)

00E0	224	PXL	CURR VERB PTR LO	E7E2	-6174	AUTO	AUTO LINE #
00E1	225	PXH	CURR VERB PTR HI	E828	-6104	IF/THEN	IF ? THEN ROUTINE
00E2	226	P1L	AUX PTR1 LO	E83C	-6061	GOSUB	
00E3	227	DELL	DELETE LN PTR LO	E858	-6056	GOTO	
00E4	228	DELH	DELETE LN PTR HI	E867	-6041	GOLINE	GOTO LINE ADDR IN *C6-C7
00E5	229	P1H	AUX PTR1 HI	E875	-6027	GETNEXT	FETCH NEXT TEXT STATEMENT
00E6	230	FLAC	GEN'L FLAG BYTE	E8A5	-5979	RETURN	
00E7	231	P2L	AUX PTR2 LO	E8C3	-5949	STOPPED AT	PRINT 'STOPPED AT LINE #'
00E8	232	LNAL	LINE # ADDR LO	E8D6	-5930	NEXT	NEXT END LOOP
00E9	233	LNAL	LINE # ADDR HI	E93A	-5830	FOR	FOR INITIAL ENTRY
00EA	234	P2H	AUX PTR2 HI	E950	-5808	TO/FOR	LOOP CNTR # 10 # STEP #
00EB	235	NXTL	NEXT PTR LO	E910-EA87	-5616 -5497	VERBADRL	VERB DISPATCH TAB LO
00EC	236	P3L	AUX PTR3 LO	EAB8-EAF7	-5496 -5377	VERBADRH	VERB DISPATCH TAB HI
00ED	237	NEXH	NEXT PTR HI	EB00-EB79	-5376 -5223	MESSTXT	ERROR MESS. TEXT
00EE	238	P3H	AUX PTR3 HI	EB8A	-5207	INPUT	INPUT ROUTINE
00EF	241	TOKNDX	TOKEN INDEX VAL	EC00-EDFF	-5120 -4607	SYNTABL	SYNTAX TABLE LIST
00F0	242	CONL	CONTINUE PTR LO	EE03	-4605	PRINTSTR	PRINT A STRING
00F1	243	CONH	CONTINUE PTR HI	EE22	-4574	LEN	
00F2	244	AUTOINCL	AUTO INC VAL LO	EE3A	-4556	GETVAL<255	GET VALUE < 255
00F3	245	AUTOINCH	AUTO INC VAL HI	EE3F	-4545	PLOT	
00F4	246	AUTOLNL	CURR AUTO LINE # LO	EE4E	-4530	COLOR	
00F5	247	AUTOLNH	CURR AUTO LINE # HI	EE54	-4524	MAN	
00F6	248	AUTOMODE	AUTO FLAG	EE57	-4521	VTAB	
00F7	249	COUNT	GEN'L CNTR BYTE	EE68	-4504	RNGERR	PRINTS '*** RANGE ERR'
00F8	249	CHAR	CURR CHAR	EEA0	-4448	CALL	CALL A ML SUBR
00FA	250	LEADZR	LEADING ZEROS INDEX	EEB0	-4432	HLIN	
00FB	251	FORNDX	FOR/NEXT LOOP INDEX	EEC6	-4410	VLIN	
00FC	252	GOSUBNDX	GOSUB INDEX	EEI3	-4397	PRINT	PRINT ERROR MSG/BELL
00FD	253	SYNSVNDX	SYNTAX STACK INDEX VAL	EEF6	-4362	PEEK	
00FE	254	SYNPAGE	SYNTAX PAGE PTR LO	EF00	-4352	GETVAL255	GET A VALUE FOR 1 BYTE
00FF	255	SYNPAGH	SYNTAX PAGE PTR HI	EF08	-4344	POKE	
0200-02FF	512-767	INBUFF	INPUT BUFFER	EF10	-4336	DIVIDE	
E000	-8192	CNTLB	COLD ENTRY	EF1E	-4322	DIMVARB	DIMENSION A VARIABLE
E003	-8189	CNTLC	WARM ENTRY	EF4E	-4274	RND	RANDOM # GENERATOR
E006	-8186	SETPRMP1	SET UP > PROMPT	EFEC	-4116	RUN	RUN FROM BEGINNING
E02A	-8150	NXTBYTE	GET NEXT BYTE 16BIT PNTR	EFF2	-4110	RUN #N	RUN FROM LINE #
E04B	-8117	LIST	LIST ALL	F000	-4096	SCRATCH	SCRATCH EVERYTHING
E05D	-8099	LISTXY	LIST A RANGE	F04D	-4019	HIMEM	
E07D	-8083	UNPACK	TOKENED CODE TO MNEMONICS	F0C9	-3895	LOMEM	
E130	-7888	DIMSTR	DIMENSION A STRING	F0DF	-3873	LOAD	LOAD A PGM FROM TAPE
E171	-7823	INPUTSTR	INPUT A STRING	F11E	-3810	SETHDR	SETUP HDR FOR SAVE/LOAD PARAM
E222	-7646	MULT	MULTIPLY	F12C	-3796	SETBUF	SETUP PGM SAVE/LOAD PARAM
E27A	-7558	MOD		F140	-3776	SAVE	SAVE A PGM TO TAPE
E28A	-7542	SCRN	RETURN SCRN COLOR	F161	-3743	PRINTERR	PRINT AN ERROR MESS
E2B3	-7501	MAINLINE	MAIN COMPILER/EXEC CODE	F167	-3737	POP	
E36B	-7317	MEMFUL	PRINTS '*** MEM FULL ERR'	F171	-3727	TRACE	
E36F	-7313	DELETE	DELETE LINES X-Y	F176	-3722	NOTRACE	
E3C0	-7232	ERRORMESS*	INPUT ERROR MSG	F17D	-3715	TRACEIT	EXEC TRACE FUNC
E3CE	-7218	GETCMD	GET KEYBOARD CMD	F279	-3463	STEP	FOR/NEXT STEP FUNC
E3E0	-7200	ERRORMESS	PRINT ERR MSG GOTO MAINLINE	F2E0	-3360	NODSP	
E51B	-6885	HEX/DEC	PRINT VAL(X=LO ACC=HI) 0-65535	F304	-3324	DSP	
E56D	-6803	LINADR	FIND LINE #'S ADDRESS	F30A	-3318	CON	CONTINUE EXEC
E5AD	-6739	NEW		F31D	-3299	ASC	
E5B7	-6729	CLR		F33B	-3269	POL	
E6EC	-6420	BRANCH	GET LO/HI THEN JSR	F351	-3247	RDKEY	READ AN INPUT
E6FF	-6401	GETVERB	NEXT VERB TO USE	F371	-3215	EXP ^	RAISE TO A POWER
E715	-6379	GET16BIT	GET A 16-BIT VAL	F3C9	-3127	PR#S	
E736	-6346	NOT		F41A	-3046	IN#S	
E74A	-6326	ABS					
E75C	-6308	SGN					
E782	-6270	SUBTRACTION					
E785	-6267	ADDITION					
E7A1	-6236	TAB					
E7C1	-6207	COMMA					

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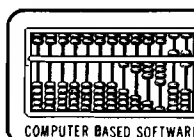
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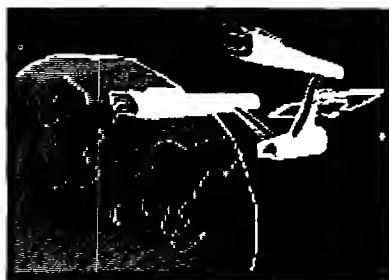
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# Atari Error Messages

**This program, when included in a BASIC program, will display the English language versions of Atari's number-coded error messages.**

David P. Allen  
19 Damon Road  
Scituate, Massachusetts 02066

Within a few days after putting my Atari computer in operation I wound up with a sore thumb. This was a result of having to continually thumb through the Atari manual to find out the meaning of the latest error message which the Atari was giving me. My threshold of discontent was being depressed lower and lower by the invidious message "ERROR- 12 AT LINE 200", which continually thrust me back to the manual to find out just what I had done wrong. I figured there had to be a better way. There is.

Atari BASIC language is equipped with the very handy 'TRAP' function which you can cause to spring into action every time it encounters an error condition. This command tells the computer to go to the line number immediately following the command (such as TRAP 32000) and continue executing the program at that point. The solution to my problem was simply to direct the computer to a list of error messages with instructions to find the right message, and then print it out on the screen in plain English.

Here's the way it works. The error trapping subroutine is started at line 32500, high enough to be included in most programs without getting in the way of the rest of the program. Way up in the beginning, at the earliest line possible (line 0 is a good place) we enter 'DIM SNAP\$(50): TRAP 32500'. This sets up SNAP\$ to collect the error messages ('snap', 'trap', — get it? Oh, well...) and instructs the program to

```
2 PRINT " ": REM CLEARS SCREEN
5 DIM SNAP$(50):TRAP32500
6 REM
7 REM
10 REM <<< ERROR TRAPPING DEMO >>>
20 REM <<< BY DAVID P. ALLEN >>>
30 REM
40 REM
50 REM
60 REM
70 REM
80 REM THIS PROGRAM DEMONSTRATES
90 REM THE PRINTOUT OF ERROR
100 REM STATEMENTS. THE FOLLOWING
110 REM LINES ARE DESIGNED TO PRO-
120 REM DUCE ERRORS. AFTER EACH
130 REM ERROR, TYPE 'GOTO' PLUS THE
140 REM THE LINE NUMBER WHERE THE
150 REM ERROR OCCURRED +10. I.E.,
160 REM IF THE ERROR MESSAGE SAYS
170 REM THE ERROR OCCURRED AT LINE
180 REM 220, THEY TYPE 'GOTO 230' TO
190 REM CONTINUE THE DEMONSTRATION
195 REM
197 REM
200 GOTO 1000
210 NEXT X
220 READ Y
230 SAVE "D2:TEST"
240 PRINT #1,A$
250 PRINT " ": POSITION 5,12
260 PRINT "**** END OF DEMONSTRATION ****"

270 END
326 LIST 32660
32490 REM <<< ERROR TRAPPING >>>
32491 REM <<< SUBROUTINE >>>
32493 REM
32494 REM
32495 REM INSERT 'DIM SNAP$(50):
32496 REM TRAP 32500' AT AN
32497 REM EARLY LINE NUMBER.
32498 REM
32499 REM
32500 SNAP = PEEK (195):LNM = 256 * PEE
K (187) + PEEK (186):GOSUB SNAP + 32500:
PRINT "**** ":SNAP$: PRINT "AT LINE ";LNM;"
****"
32501 TRAP32500: PRINT " ": END
32502 SNAP$ = "INSUFFICIENT MEMORY": RETU
RN
32503 SNAP$ = "VALUE ERROR": RETURN
32504 SNAP$ = "TOO MANY VARIABLES": RETU
RN
32505 SNAP$ = "STRING LENGTH ERROR": RETU
RN
```

proceed at line 32500 whenever it encounters an error condition. Line 32500 takes a PEEK at two locations which find out first what error occurred (SNAP), and where it occurred (LNM). The computer then finds the correct error message and prints it out on the screen.

Line 32501 resets the trap and ends the program, but you can have your program continue. If you replace 'END' with 'INPUT A\$: GOTO LNM + 10' your program will pause at the error message while you reflect on the wisdom of what it is telling you, then when you press 'RETURN' the program will jump to the line number that is ten places further down from where the error occurred. To make this work, all your line numbers must be ten numbers apart, and you must 'DIM A\$(1)' back in the beginning of the program. If you leave 'END' in place in line 32501, then you must use 'RUN' or some other immediate command to get things going again.

To save this program for inclusion in your future programs, enter lines 32500 through 32761 into memory through your keyboard. If you are going to save the routine on cassette, then set the program recorder up to record and execute 'LIST "C:"' and the whole nine yards will be saved on your tape in tokenized form. To retrieve it for use in another program execute 'ENTER "C:"' after cuing up your tape to the right spot for this routine. The error trapping subroutine will then be added to whatever program you have in BASIC memory at that time.

Disk users follow almost the same routine except use 'D:' and a filename where 'C:' is mentioned above. The filename will be the one you use to identify this subroutine on your disk. I use 'ERRSUB.LST' which reminds me that this file was put on the disk with a 'LIST' instead of a 'SAVE'.

That's all there is to it. If you enter the listing contained herein, the line numbers below 32490 will cause a demonstration of the subroutine procedure to be executed. The price you pay for all of this is the use of 1982 bytes of memory. Atari 800 users with 48K of RAM memory will not give this a second thought; Atari 400 users with only 8K will pause and reflect before dedicating almost 2K to the reduction of their irritation. If it fits your program and your memory then try it out. You'll like it.

**MICRO**

```

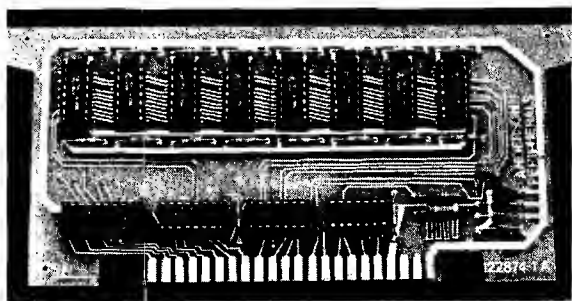
32506 SNAP$ = "OUT OF DATA": RETURN
32507 SNAP$ = "ERROR > 32767": RETURN
32508 SNAP$ = "INPUT STATEMENT ERROR": RETURN
32509 SNAP$ = "DIM ERROR": RETURN
32510 SNAP$ = "ARGUMENT STACK OVERFLOW": RETURN
32511 SNAP$ = "FP OVER/UNDERFLOW ERROR": RETURN
32512 SNAP$ = "LINE NOT FOUND": RETURN
32513 SNAP$ = "NEXT WITHOUT FOR": RETURN

32514 SNAP$ = "LINE TOO LONG": RETURN
32515 SNAP$ = "GOSUB/FOR LINE DELETED": RETURN
32516 SNAP$ = "RETURN WITHOUT GOSUB": RETURN
32517 SNAP$ = "GARBAGE": RETURN
32518 SNAP$ = "INVALID STRING CHARACTER": RETURN
32519 SNAP$ = "CAN'T LOAD - TOO LONG": RETURN
32520 SNAP$ = "DEVICE # >7 OR =0": RETURN

32521 SNAP$ = "NON-LOAD FILE": RETURN
32628 SNAP$ = "BREAK KEY ABORT": RETURN
32629 SNAP$ = "IOCB ALREADY OPEN": RETURN

32630 SNAP$ = "NON-EXISTENT DEVICE": RETURN
32631 SNAP$ = "IOCB WRITE ONLY": RETURN
32632 SNAP$ = "INVALID COMMAND": RETURN
32633 SNAP$ = "DEVICE/FILE NOT OPENED": RETURN
32634 SNAP$ = "ILLEGAL IOCB #": RETURN
32635 SNAP$ = "IOCB READ ONLY": RETURN
32636 SNAP$ = "END OF FILE": RETURN
32637 SNAP$ = "RECORD > 256 CHARACTERS": RETURN
32638 SNAP$ = "DEVICE DOESN'T RESOND": RETURN
32639 SNAP$ = "GARBAGE AT SERIAL PORT": RETURN
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32662 SNAP$ = "DISK FULL": RETURN
32663 SNAP$ = "UNRECOVERABLE SYSTEM DATA - I/O ERROR": RETURN
32664 SNAP$ = "FILE NUMBER MISMATCH": RETURN
32665 SNAP$ = "FILENAME ERROR": RETURN
32666 SNAP$ = "POINT DATA LENGTH ERROR": RETURN
32667 SNAP$ = "FILE LOCKED": RETURN
32668 SNAP$ = "INVALID COMMAND": RETURN
32669 SNAP$ = "DIRECTORY FULL": RETURN
32670 SNAP$ = "FILE NOT FOUND": RETURN
32671 SNAP$ = "POINT INVALID": RETURN

```



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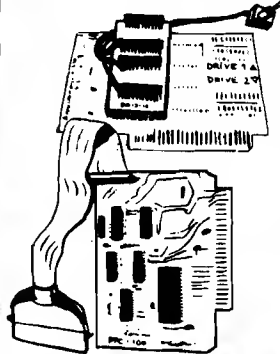
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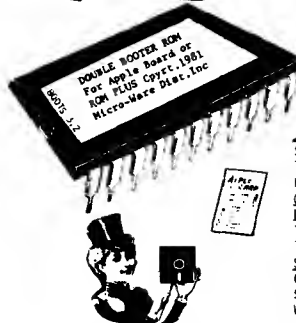
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## Introduction to OS-65D V3.3

OS-65 V3.2 was an ultra sophisticated development-oriented operating system. However, several problems kept arising:

1. Output was difficult to format in BASIC.
2. There was no way to trap disk errors in BASIC.
3. Disk file operations were both slow and limited.
4. The nature of the OSI polled keyboard made the use of lower case alphabets tedious.

OS-65D V3.3 has been designed to eliminate these problems in earlier releases of 65D. In addition, the 65D BASIC line editor has been added as a permanent feature of BASIC. The following describes all the changes that have been made in V3.3. Enjoy!

### Compatibility

OS-65D V3.3 has the BASIC workspace moved to \$3A7E as opposed to \$327E on OS-65D V3.2. This change makes no difference whatsoever to the average BASIC programmer. In fact, enhancements to 65D V3.3 allow existing V3.2 files to be both upward and downward compatible to the new system. However, care must be taken when using V3.2 files that contain assembler language subroutines. The subroutines will be transferred, along with the program that contains them, but will be physically relocated in memory and will probably not execute properly, if at all.

### Programmable Error Action

In OS-65D V3.3 BASIC, the WAIT command has been replaced by the TRAP function which is used as an "ON ERROR GOTO" (but is easier to type). The TRAP function can be used either in the immediate mode or inside BASIC program and is effective whether a BASIC ERROR or DOS ERROR occurred. For example, consider the following program segment:

```
10 TRAP 1000
20 DISK OPEN,6,"DATA"
30 TRAP 40
40 INPUT#6,A:B=A/A
50 PRINT A:END
1000 ?"DISK ERROR":END
```

If a DISK ERROR occurred in line 20, control would be transferred to line 1000. Lines 30 and 40 are used to read the first non-zero number in the file. The TRAP function is disabled by the statement "TRAP0".

### Keyboard Driver

The standard OSI polled keyboard driver has been replaced in OS-65D V3.3 by an all new keyboard decoder. The SHIFT LOCK key now acts as a CAP LOCK key and the RUBOUT key actually does delete characters. However, three characters still cause problems. These are listed below along with their keystroke equivalents:

```
^ - SHIFT N
[ - SHIFT K
] - SHIFT M
```

**Note:** The SHIFT LOCK key must be depressed when these three characters are typed.

### Random Files

OS-65D V3.3 incorporates several improvements in the random file capabilities in OS-65D. First, the DISK GET command has been altered to check which track is currently resident in RAM before actually reading a track. If the GET command determines that this is the track that is needed, no reread is performed. Thus, the random file access time is up to 48 times faster than in 65D V3.2.

Secondly, a DISK FIND command has been added. The syntax is "DISK FIND,string" where string is any BASIC string variable or quoted literal. The search begins at the current file pointer and will continue through the file. If the string is not found, an ERR#D will be reported (unless the TRAP command is used). If the string is found, the file pointer will be set to the beginning of the *next* field entry. For example:

```
10 DISK OPEN,6,"DATA"
20 DISK GET,10
30 PRINT#6,"HELLO":PRINT#6,"THERE!"
40 DISK GET,0
50 DISK FIND, "HELLO"
60 INPUT#6,A$
70 PRINT A$
```

This program will print out "HELLO!".

**Note:** The search rate for the FIND command is about 8K/second on 8" systems and 5K/second on mini-floppies.

### Printer Drivers

The printer drivers in OS-65D V3.3 (devices 1 and 4) have a programmable paging feature which is enabled by the following:

```
PRINT#LP,CHR$(27);"C";CHR$(FL)
```

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where LP is the printer device number and FL is the form length you want. Ten percent of the form length is always reserved for the top and bottom margins. For example,

```
PRINT#1,CHR$(27);"C";CHR$(66)
```

indicates form length of 66 where 60 lines are printed per page and six lines are reserved for the top and bottom margins. Immediately after the form length is set, a top of form is executed. At this time, position the paper in the printer as desired. To print a top of form to the next page, enter

```
PRINT#LP,CHR$(12);
```

The printer drivers also have a screen dump utility which may be used if you have an EPSON MX-80 printer and a standard OSI 540 video system. To use this feature, enter

```
PRINT#LP,CHR$(27);"P";
```

## OS-65D V3.3 Editor

In OS-65D BASIC, the keyword NULL is replaced by the word EDIT. After the system is booted, immediately type a non-destructive forward and backspace to tell the editor what type of keyboard you are using, (CTRL-L and CTRL-P are the forward space and backspace, respectively, for the OSI keyboards.) The syntax for editing a line is given in table 1.

Table 1

0 = < LN < 64000

EDIT LN < CR > or !LN < CR >	Edit the statement with the line number LN.
EDIT! < CR > or !! < CR >	Edit the same line that was just edited.
EDIT < CR > or ! < CR >	Edit the line immediately following the line that was just edited.

The line with its line number will be displayed following the < CR >. If the line number LN does not exist, the statement with the next line number will be displayed. (Typing EDIT0 or !0 will always give the first line of the program.) After the statement is displayed, the cursor will reside at the end of that line. The commands listed in table 2 are used for the actual line editing.

Table 2

→ /CTRL-L/Forward Space	Non-destructive forward space. Moves the cursor one space to the right.
← /CTRL-H/CTRL-P/Backspace	Non-destructive backspace. Moves the cursor one space to the left.
RUBOUT/DELETE/SHIFT-0	Single character delete. The editor makes the correct delete keys operational as well as the old ones (i.e., the RUBOUT key as well as SHIFT-0 will work on the OSI polled keyboard when the editor is enabled).
@/SHIFT-P	Entry delete. This will erase the line currently being edited, leaving the line in the text as it was before it was edited.
CTRL-R	Non-destructively moves the cursor to the rear of the statement.
CTRL-F	Non-destructively moves the cursor to the front of the statement.
CTRL-I	Non-destructively moves the cursor eight spaces forward (to the right).
CTRL-T	Retypes the statement you are currently editing.
< CR > / < RETURN > / < ENTER >	Enters the line as written or viewed. The line will look (to the BASIC interpreter) as if it were typed in by the user from scratch.

Character insertion and deletions can be accomplished anywhere by using the commands for non-destructive movement of the cursor. After the cursor is positioned, the user can type in insertions or delete unwanted characters. **Note:** Characters are inserted to the left of the character on which the cursor resided. The character on which the cursor resides is deleted until the end of the line is reached, and the characters to the left will be deleted if the cursor resides at the end of a line.

### Video Driver

The video driver for 65D has been rewritten in order to provide (X,Y) cursor addressing and more than a dozen screen editing commands. These commands are used by printing CHR\$(27), an ASCII ESC, followed by the desired command. For example,

```
PRINT CHR$(27);CHR$(28);
```

clears the video screen and homes the cursor. The rest of the commands are given in table 3.

**Table 3**

Code	Effect
CHR\$(1)	Causes following data to be printed in the color yellow.
CHR\$(2);CHR\$(n); CHR\$(m)	All screen positions marked by color n are changed to color m.
CHR\$(5)	Sends the current cursor address through the keyboard driver, i.e., <pre>PRINT CHR\$(27); CHR\$(5);:INPUT A\$</pre> then, <pre>A\$ = CHR\$(65 + X) CHR\$(65 + Y)</pre>
CHR\$(11)	Cursor moves down one line.
CHR\$(12)	Cursor moves up one line.
CHR\$(15)	Clears from the current cursor position to the end of line.
CHR\$(17);CHR\$(X); CHR\$(Y)	Moves cursor to screen position (X,Y). $0 \leq X < 64$ $0 \leq Y < 24$

CHR\$(18)	Moves cursor to the home position, i.e., (0,0) — the upper left-hand corner.
CHR\$(19)	Deletes the line the cursor is on. Lines below the cursor scroll up one line.
CHR\$(24)	Clears from the current cursor position to the end of the screen.
CHR\$(25)	Causes output to be printed in no color (black).
CHR\$(26)	Inserts a line at the cursor position. Lines below the cursor scroll down one line.
CHR\$(28)	Clears screen and homes cursor.
CHR\$(29);CHR\$(n)	Clears all occurrences of color n on the screen.
CHR\$(31);CHR\$(n)	Causes the following data to be printed in the color n.
CHR\$(33)	Sends the character at the cursor position through the keyboard driver, e.g., <pre>Print CHR\$(27); CHR\$(33) INPUT A\$</pre>

### Indirect File Problems? Why Not Use a Diskette?

In this section we describe a method for merging two BASIC files under the OS-65D operating system. The procedure uses the disk I/O capabilities of 65D to make your diskette into an indirect file. The following step-by-step procedure can be used to merge two programs. We start with both programs, say PROG1 and PROG2, stored on a diskette.

```
PROG1 N1 = 1 TRACK
40 REM THIS IS PROG1
50 REM
60 REM
70 END
```

```
PROG2 N2 = 1 TRACK
10 REM THIS IS PROG1
20 REM
30 REM
40 END
```

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1. Load PROG 1 into the workspace

```
DISK!"LOAD PROG1"
```

Enter

```
EXIT
```

The number of tracks necessary to hold PROG1 will be displayed, say N1 tracks. Return to BASIC by entering

```
RE BA
```

Now do the same with PROG2, obtaining its size, N2 tracks.

2. Run the disk utility CREATE and create a file PROG3, N1+N2 (N3) tracks long, to hold the merged programs. If PROG2 already has enough space, the merged program can be stored as PROG2.

3. The number, N1, of tracks necessary to store PROG1 was determined in step 1. Run CREATE again and make a file called "DATA" with three times N1 tracks for a five inch diskette, and four times N1 tracks for an eight inch diskette. Answer NO to the query about pages per track. Specify four pages per track.

4. Load PROG1 into the workspace

```
DISK!"LOAD PROG1"
```

5. Enter the following POKes to create a four-page buffer and to disable the scrolling of the screen (the screen will hold the buffer).

```
POKE 8998,0
POKE 8999,208
POKE 9000,0
POKE 9001,212
POKE 9770,0
```

6. Enter on a *single line*

```
DISK OPEN,6,"DATA":DISK!"IO ,22":LIST
```

A listing of the workspace will appear on the screen while PROG1 is being stored in the file DATA.

7. When the listing is finished, reset the I/O pointers and close the file by entering

```
DISK!"IO 02,02":DISK CLOSE,6
```

8. Load PROG2 into the workspace by entering

```
DISK!"LOAD PROG2"
```

9. Reopen the file DATA and merge PROG1 into PROG2 by entering

```
DISK OPEN,6,"DATA":DISK!"IO 20"
```

10. Reset the I/O pointers, close the file, and enable scrolling by entering

```
DISK!"IO 02,02":DISK CLOSE,6
POKE 9770,64
```

11. Store the merged file by entering

```
DISK!"PUT PROG3"
```

12. Clean house by rebooting the system.

If each of the programs has a line with the same number, the line in PROG1 will be the one that appears in the merged program.

```
MERGED PROGRAM PROG3 N3 = 1 TRACK
N1 + N2
```

```
10 REM THIS IS PROG2
20 REM
30 REM
40 REM THIS IS PROG1
50 REM
60 REM
70 END
```

*Note:* Line 40 of PROG2 was overwritten.

Finally, by changing the LIST specification in step 6, you can merge any part of a program, or just break up large programs. The uses are unlimited.

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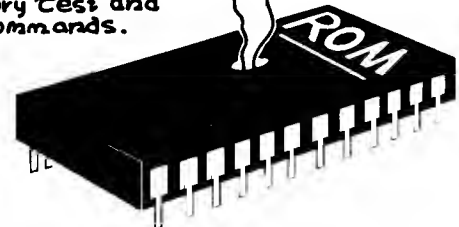
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# MICRO

## Challenges

By Paul Geffen

### The Superboard

The OSI Model 600, better known as the Superboard, is one of the oldest of the single-board microcomputers. At \$299 (list) it provides more computing power per dollar than almost any other system in its class. For the beginner this system is close to ideal, both affordable and accessible.

For \$299 you get one board with these features: a typewriter-style keyboard, a 6502 microprocessor, 4K of program RAM, 1K of display RAM, video output circuitry, 8K Microsoft BASIC-in-ROM and a 2K ROM monitor. The board comes with a User's Manual to help the beginner find his way around. You will also need a power supply (five volts at two amps) and a video monitor or an RF modulator to connect the computer to a TV set. These may cost between fifty and two hundred dollars more.

Or you could buy the OSI C1P for \$429, which is a Model 600 with an extra 4K of program RAM in a case with a power supply. A good cassette recorder (not battery operated) is almost essential, and you would do well to arm yourself with additional reference materials which I will describe below.

Now you have a complete computer system which will allow you to write programs in BASIC and/or machine language. You can also run programs which others have written, as long as they were written for the OSI Superboard or C1P. Converting BASIC programs from other machines is sometimes easy, but sometimes almost impossible. For instance, tapes written for other micros probably won't load on the OSI.

### Information Resources

As they become more experienced, most beginners notice that there is a lot that can be done with the Superboard that isn't explained or even hinted at in the OSI documentation. Many of the apparent limitations of the board are really only deficiencies in the User's Manual. Of course this is what user's

groups are for. There are a few good books available which offer much useful information, both for the beginner and the experienced programmer.

Perhaps the best to start with is Ed Carlson's *OSI BASIC in ROM*. This book, now in its second edition, is written by a C2P/C4P user, but almost everything in the book applies to the Superboard because the same BASIC comes with both machines. Carlson describes the capabilities of BASIC in considerably more detail than the User's Manual and he includes a few things the manual leaves out, like the bugs. Carlson goes into detail on solutions to the infamous Garbage Collector bug (which OSI doesn't even mention). Then he explains how to write good, well-organized BASIC programs and he provides many useful utility programs for clearing the screen (fast), converting hex to decimal, writing monitor format tapes, and so on.

The material on the actual mechanics of the BASIC interpreter is very useful and informative, and gives the key to many clever and efficient ways of writing programs for this machine. Finally, this book has a comprehensive list of publications and vendors of software for the OSI. In short, this is the book every Superboard owner should have alongside his User's Manual.

The next book I recommend for the more experienced user, is Williams and Dorner's *First Book of OSI*, published by Aardvark Technical Services. (Do not confuse this with a book with almost the same title, by Clothier and Adams, published by ELCOMP.) Williams and Dorner provide much of the same information as Carlson, with less introductory material, and more technically sophisticated material. Williams and Dorner's book is not for the beginner, as Carlson's is, so this should be the second book to buy.

The User's Manual does have some good points, namely a good job of printing and production. Of the books I have mentioned, it has the best graphics table and the best hex-to-decimal conversion table. Carlson has the most complete map of BASIC ROM entry points. Williams and Dorner go into more detail on what the ROM routines do.

The *First Book of Ohio Scientific* and *Second Book of Ohio Scientific* by Clothier and Adams contain mostly promotional material reprinted from OSI newsletters and entries from the

"Small Systems Journal." Most of the informative material here is also available, and better presented in Carlson's or Williams and Dorner's books.

Unfortunately, that about covers the available books written specifically for the OSI user. In addition to these books, two other sources of information exist: periodicals and plans for sale.

Two of the best periodicals were described last month, the *OSIO Newsletter* and *PEEK(65)*. I also recommend the *Aardvark Journal*, which is now about six issues old. This is a bi-monthly journal, published by a leading supplier of software for OSI systems. For more information write to: Aardvark Journal, 1690 Bolton, Walled Lake, Michigan 48088.

There is one other OSI-only publication, the *Independent Newsletter*, O. S. I. U. I. N. put out by Charles Curley at 6061 Lime Ave., #2, Long Beach, California 90806. I have seen only one issue of this, and I don't feel it is enough to judge this relatively young newsletter.

MICRO publishes at least one OSI-related article each month as well as this column. *COMPUTE!* has an "OSI Gazette" and *Kilobaud Micro-computing* runs about four or five OSI-related articles per year.

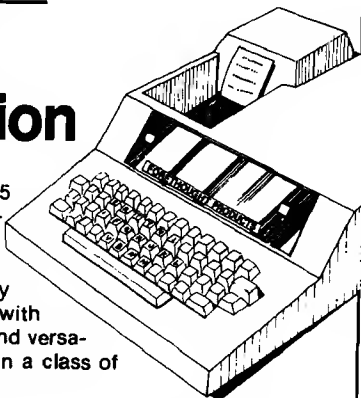
All of these publications supply short programs and hardware projects of real utility as well as good introductory material.

Finally, it is possible to buy plans and/or kits for various modifications to the Superboard. Ads for these run in MICRO and other publications, and similar plans can be found in the above-mentioned publications. For instance, Video Mods, to increase the number of characters displayed per line, are described in Aardvark #5 [simple], and *PEEK(65)* #11 [complex].

I plan to publish a more complete list of OSI information resources in a future column. I am sure that I have overlooked some newsletters and magazines. I am particularly interested in boards or kits or plans that will: expand the Superboard memory, expand the video display, increase the cassette speed, and provide RS 232 and modem support. Please send catalogs, etc. in care of this column, to ensure your product's inclusion in this list.

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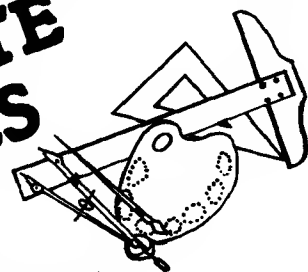
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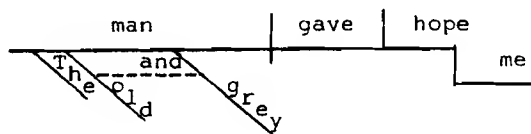
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# BASIC Program Converter Between SYM and KIM

This program allows a person to transfer BASIC programs from SYM to KIM or from KIM to SYM without having to spend hours typing in and debugging the programs.

Lee Chapel  
2349 Wiggins  
Springfield, Illinois 62704

Have you ever wanted to put somebody's SYM BASIC program on your KIM without spending hours typing the program in and debugging it? Or have you ever wanted to put somebody's KIM program on your SYM? This converter program allows you to easily transfer BASIC programs from SYM to KIM, or from KIM to SYM. It is especially useful for long, 8 to 12K, programs. I used it to transfer a 14K program I call "Monster Combat" from KIM to SYM in roughly half an hour.

## Description of BASIC Format

The BASIC format used in the SYM and KIM is as follows. The first two bytes of a program line point to the start of the next line (see diagram). The next two bytes are the line number, and the remaining bytes are BASIC tokens or data in ASCII. A token is one byte (80 to C5 hex) which represents a 2 to 6 letter BASIC word.

## Tokens or Data in ASCII Code (Hex)

LO HI	LO HI
Byte	Byte
Next line	Line number
pointer in hex	in hex

The tokens in both SYM and KIM (such as INPUT and PRINT) are the same hex value. For example, on both systems INPUT is 84 in hex, and PRINT is 97 in hex. An example of how a BASIC line is formed is shown in figure 1.

Figure 1

4000	00	14	40	05	00	97	22	48	49	20	54	48	45	52	45	22	3A	88	35
Pointer	Line	PR	"	H	I	T	H	E	R	E	"	:	G	O	T	O	5		
to next	num	INT																	
line	ber																		

## Comparison of SYM and KIM Systems

KIM begins program storage at 4000 hex, SYM begins storage at 0200 hex. Since the data and the tokens are the same, only the line pointers and actual program location in memory need to be changed. The program can be relocated on SYM by use of the Block Move, "B". On KIM the use of a supplementary monitor such as "XIM" can be used to relocate the program. It's also possible to relocate the program by using the tape load FF function and new address. The regular KIM tape record and playback are the same as the low speed SYM tape record and playback.

The only remaining difference between the two systems is the pointer values. They all need to be changed to reflect the new location in the other system. The BASIC converter program is written to convert all these pointer locations. The BASIC program takes only a few seconds to convert long programs, so speed is not a problem.

## Converter Program Description

In both program listings, A is the address where the low byte of the first pointer is located. B is the value found in the address A, and C is the value of the high byte of the pointer. D is set

equal to the first hex digit of C, and E is set equal to the other hex digit of C. D, E, and B are then placed in an equation where F becomes the value of the address of the next line pointer. Since only the high byte needs to be changed, the address A+1 is POKed with a new value. A is then set equal to F and the entire process continues with a new value of the line pointer until two zeros are found in adjacent addresses.

## Program Examples

The following is an example of a KIM to SYM conversion. First check addresses 7D and 7E. These are, respectively, the low and the high bytes of the end of the program being transferred. Make a record of these values and make a recording from 4000 hex to the address in those two memory locations at normal record speed. Next the tape is loaded into SYM at slow speed and placed in memory so that it starts at 4000. SYM BASIC is then entered with a J 0 and when Memory Size is asked for, a low value, such as 1500, should be entered. Type in the converter program. Make sure there are no errors and then run the program. Once the program finishes, go back into the monitor, move the program at 4000 hex down to 0200 hex. Take the value in 7D that you noted and subtract 3E hex

from it, and place that number in 7D. Next take the value noted for 7E and place it in 7E. Then set memory locations 87 and 88 to the proper size of your BASIC program area.

Converting from SYM to KIM is similar. Again, check memories 7D and 7E and make a note of them. Make a tape of the program in the SYM's low speed format. Load it into KIM and place it in memory so that it starts at 5000 hex. Then start KIM BASIC and when you are asked for Memory Size, give a low value such as 17000. Type in the conversion program, make sure there are no errors, and run it. When the program finishes, go back to the monitor and move the converted program from 5000 to 4000. Take the value noted for 7D and add 3E hex to it. Take the value noted for 7E, and place it in 7E. Change memory locations 87 and 88 to the proper size of your BASIC program memory. After moving and testing, a final tape dump can be made.

### Conclusion

I have used both these conversion programs successfully on several BASIC programs. Any USRs or special

I/Os will have to be modified. It should also work on AIM, assuming the tokens are the same. These programs have saved many hours of retyping programs between systems.

Lee Chapel has been working with KIM and SYM for about 3 years. He is majoring in Computer Science at the University of Wisconsin-Madison and has worked there as a programmer in the Agriculture Economics department.

**MICRO**

#### Listing 1

```
5 REM SYM TO KIM CONVERSION IN BASIC
10 A=20481
15 IF PEEK(A)=0 AND PEEK(A+1)=0 THEN END
20 B=PEEK(A):C=PEEK(A+1)
25 D=INT(D/16):E=C-16*D
30 F=4096*D+256*E+B+19968
35 POKEA+1,C+62
40 A=F:GOTO 15
45 END
```

#### Listing 2

```
5 REM KIM TO SYM CONVERSION IN BASIC
10 A=16385
15 IF PEEK(A)=0 AND PEEK(A+1)=0 THEN END
20 B=PEEK(A):C=PEEK(A+1)
25 D=INT(C/16):E=C-D*16
30 F=4096*D+256*E+B
35 POKEA+1,C-62
40 A=F:GOTO 15
```

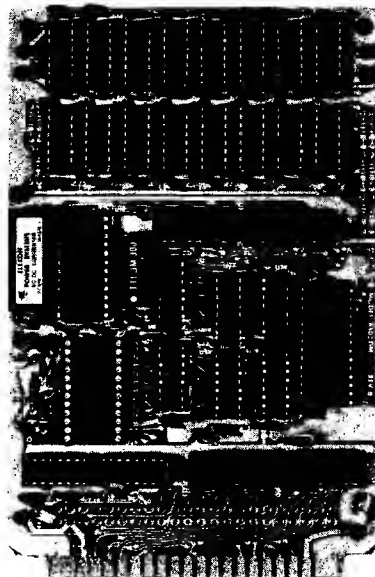
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# MICRO

## Microbes and Updates

Mike Rowe  
Microbes & Updates  
P.O. Box 6502  
Chelmsford, MA 01824

*This month, we offer the following improvements, rather than corrections.*

*Les Cain, of Grand Junction, Colorado, sent this update to his article in the January issue (32:75):* There is a problem with Control C in "Fun with OSI." I apologize to the readers for the oversight in not replacing the Disk control C POKE with the proper ROM POKE. To correct the problem, change the following lines:

```
Line 760 POKE 530,1:K = 57088
Line 1710 POKE 530,0:END
Line 1740 POKE 530,0:END
```

*Charles F. Taylor, Jr. of Monterey, California, offers the following tip:* "Business Dollars and Sense in Applesoft" by Barton M. Bauers, Jr. [MICRO 27:65] was most interesting and useful. Here are a couple of simple changes which will make the routine "Mask" even more useful:

1. "Mask" produces output left-justified in a variable-width field. While this is useful for some applications, it will not do for producing columns of figures. Ideally, the output should be right-justified in a predetermined field width (specified by the user). This can be accomplished by adding lines 16 and 15025 and by modifying line 15110 as shown below:

```
16 FW = 12 : REM SET FIELD
   WIDTH (5 =FW =12)
15025 BL$ = " " : REM 8 BLANKS
15110 XW$ = XV$ + LEFT$(BL$,
   FW - 4 - LEN(XV$)) + XV$ +
   XZ$
```

Line 16 as shown, produces the maximum allowable field width and is sufficient to handle dollar amounts from \$-999,999.99 to \$9,999,999.99, which is the range handled by Mr. Bauers' original routine, and which should be adequate for most small applications. [It is certainly adequate for my personal checkbook.] The field width can be changed anywhere in the calling program by assigning the desired value to the variable "FW". Line 15110 as shown left-justifies the leading "\$", but this is easily changed.

2. Because of the behavior of the function "INT" (described by Mr. Bauers in his article), the routine as it stands will round fractional cents incorrectly for negative amounts, e.g. -1.009 rounds to -1.00 instead of -1.01. [Fractional cents occur most often when computing percentages.] Here is a simple fix to line 15 which solves the problem:

```
15 DEF FN VL(X) = INT((X +
   SGN(X)*.0001)*100 + .5)
```

*John P. Molineaux of Cheverly, Maryland, sent this enhancement:* There is always a better way. On reading Frank Chipchase's excellent article on "Better Utilization of Apple Computer Renummer and Merge Program" in the August 1980 issue (27:17), I was struck by the awkwardness of the series of EXEC file POKES required to configure the A/S-R/N-M program. Machine language is far better than Applesoft at POKES and it doesn't fill the screen with Applesoft prompt characters ([]).

Recall that HIMEM:32352 is equivalent to POKE 115,0:POKE 116,142. Hiding A/S-R/N-M and resetting the &-pointer therefore translates to:

Assembly	Decimal
LDA 0	169 0
STA 115	133 115
STA 1014	141 246,3
LDA 142	169 142
STA 116	133 116
STA 1015	141 247,3
LDA 76	169 76
STA 1013	141 245,3
RTS	96

If this short program is appended to the front of the A/S-R/N-M and the whole mess is BSAVED as a unit under the name RENUM, then the loading and reconfiguration is quickly achieved by

BRUN RENUM

Here's how:

1. RUN Apple's RENUMBER from the system disk.

2. POKE in the 20 bytes of the program as follows:

```
POKE 36332,169
POKE 36333,0
POKE 36334,133
POKE 36335,115
POKE 36336,141
POKE 36337,246
POKE 36338,3
POKE 36339,169
POKE 36340,142
POKE 36341,133
POKE 36342,116
POKE 36343,141
POKE 36344,247
POKE 36345,3
POKE 36346,169
POKE 36347,76
POKE 36348,141
POKE 36349,245
POKE 36350,3
POKE 36351,96
```

Of course, the monitor is zippier on this kind of task, if you want to enter the hex equivalents of the decimal POKES in \$8DEC through \$8DFF.

3. BSAVE RENUM,A36332,L2068

Notice that an additional 20 bytes spill over onto one more track in the RENUM data set.

This way of saving the program saves a second or two on each run and dispenses with the screenful of empty "]" lines that scoot your last display off the screen. After the BRUN RENUM, the 20-byte program is eventually destroyed the next time an Applesoft string is created.

DDJ



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Price: \$20.00 on disk postpaid. Includes both DOS 3.2 and 3.3 versions, and documentation.

Author: **Jeffrey Durham**  
Available: **Mike Rowe Productions**  
P.O. Box 43504  
Tucson, Arizona 85733

Name: **NDE—Package**  
System: CBM Commodore  
Memory: 32K  
Language: BASIC  
Hardware: CBM 3032/  
CBM 3040/CBM 3022

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Price: \$800.00  
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Available: **M. Bauer**  
Aindorferstr.86  
D-8000 Muenchen 2A  
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Name: **0-1. Options**  
System: PET  
Memory: 8K  
Language: BASIC  
Hardware: PET/CBM

Description: Options are evaluated. A unique measure of option value is computed and used to compare options for up to three expiration dates and three striking prices. Normal prices for puts or calls may be computed for any assumed situation and tables printed as a function of stock price.

Price: \$15.00 for cassette and documentation

Author: **Claud E. Cleeton**  
Available: **Claud E. Cleeton**  
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98004

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Memory: 32K with Applesoft ROM or 48K with Applesoft RAM  
Language: Applesoft II  
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Available: **Mind Machine, Inc.**  
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Author: **John Townley and AGS Software**  
Available: **AGS Software**  
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Orleans,  
Massachusetts 02653

Name: **The Ultimate Catalog**  
System: Apple II/Apples II Plus  
Memory: Min. 20K (ROM Applesoft)  
Language: Applesoft and Machine RWTs

Hardware: Apple II, Disk II, DOS 3.2  
Description: Now you can format your directory to appear any way you wish. Block similar programs together; write

headers mid-directory; separate by sections. This 5K, menu-driven utility is easy to use and performs the following functions: Alphabetize any portion or all of directory, move any file, exchange any two files, highlight or remove highlighting from any file name, insert blank line(s), delete any file, lock or unlock all files, delete or restore all files.

Price: \$6.50 for listing/instructions

Author: **Larry Abrams**  
Available: **ARIES SOFTWARE**  
P.O. Box 58  
Los Altos, California  
94022

Name: **The Math Machine**

System: Apple

Memory: 32K

Language: Applesoft in ROM

Hardware: Disk, optional printer

Description: Kid-tested, effective instructional software to improve math skills. Covers pre-math through division with over 110 skill levels. Designed by educators and written by programmers for use by parents and teachers. Includes such features as: reinforcement system, management, record keeping, individualization, personalized lessons, performance objectives, and immediate feedback.

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Author: **Larry Johnson**  
Available: **SouthWest EdPsych Services**  
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System: Apple II

Memory: 48K

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Hardware: Apple II, Disk II (one or two drives)

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Price: \$24.95 includes disk, manual, demo sheet.

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Memory: 48K

Language: CP/M,  
[Machine Language]

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Description: Upload and download data files between the Apple and another computer. A number of "luxury" features are also provided. Commonly used systems can be put into a directory for auto-dialing, keyboard Macros allow you to define strings for output with simple keystrokes for fast log-ins to system, or to issue various commands within the system. Table-driven prefix keys allow you to produce any character not already on the Apple keyboard without losing any other keys! Fully compatible with standard CP/M sequential text files, and can send files from disk of any size, and can receive up to 36K of data at a time. Auto-save mode will send XOFF character to host, save file (with operator prompting) and then continue.

Price: \$79.95, introductory (until May 1, 1981)

Author: **Bill Blue**

Available: **Southwestern Data Systems**  
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92071

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System: OSI, C1P or Superboard

Memory: 4K

Language: 8K BASIC-in-ROM

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Price: \$5.95 ppd.  
includes cassette and documentation

Author: **Brian and Craig Zupke**

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System: OSI C4P MF

Language: BASIC under OS65D

Hardware: Printer, 2 Disks (second optional)

Description: Provides double-entry journal system for cash flow analysis and reports. Automatic checking of distribution account totals at time of entry. User-defined fields in data base files; up to 99 expense and income accounts, 999 vendor/customer accounts, with names up to 72 characters. Six digit (XXXX.xx) capability in base module is expandable. Prints Income Statement, Trial Balance, Charts of Accounts and Vendor/Customer lists. Summary financial information totalable by month, quarter, and YTD. Sorting is available on user specified fields. All records are MDMS compatible and code allows user system configuration.

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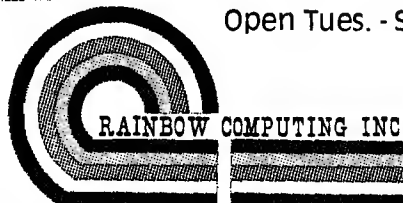
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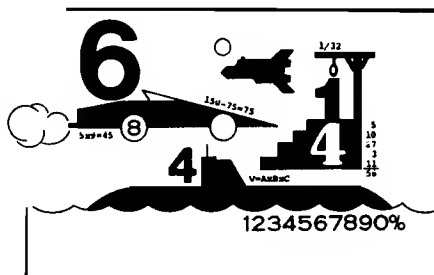
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it, you can see how much land you hold, how much of it is under the plow and how adequate your defenses are. We are unique in that here, the map IS the territory.

I trust that I have been of help, signore. I look forward to the day when I may address you as His Royal Highness, King of Santa Paravia. *Buona fortuna* or, as you say, "Good luck". For the Apple 48K.

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# Apple II<sup>TM</sup> Memory Management System<sup>TM</sup>

## A LITTLE HISTORY

Many years ago, when the Apple II first came out, it was possible to program a 48K computer. At this time you were somewhat constrained to Integer BASIC and a cassette storage medium.

Shortly thereafter, APPLESOFT<sup>TM</sup> appeared. The original (RAM) version improved upon the Apple's capabilities but reduced the programmer memory by about 12K. You could now do more but had less memory to do it with.

The situation soon changed again when Apple introduced the APPLESOFT ROM card. For \$195 the programmer now had both Integer and APPLESOFT capabilities and 48K available.

In keeping with tradition, Apple followed the ROM card with an even more classier act: the Disk drive. A majority of Apple owners now have a 48K Apple computer with Integer BASIC, APPLESOFT, and a Disk Operating System (DOS). But the 48K in the computer is no longer fully available to the programmer since DOS occupies 10.5K of memory (actually 10752 bytes). A 48K Apple actually has 37.5K of programmable memory if DOS is booted.

## THE MEAT OF THIS AD

MEMORY MANAGEMENT SYSTEM (MMS)<sup>TM</sup> by C.D.S. is a unique, exciting **new** way to get back the 10.5K of memory allotted to DOS. Here's how it operates:

- (1) A 48K Apple is configured with a 16K RAM EXPANSION BOARD in slot 0, and an APPLESOFT card or another 16K RAM EXPANSION BOARD in slot 4.
- (2) DOS is booted as you normally would, using a DOS 3.3 System Master diskette, or DOS 3.2 BASICS diskette followed by a DOS 3.2 System Master.
- (3) BRUN the **MMS** program.

In a few seconds your Apple computer will recognize both Integer BASIC and APPLESOFT **AND** the DOS will be relocated on the 16K RAM EXPANSION BOARD!

With DOS now resident on the 16K RAM board, 10.5K of memory is **released** for your programming use.

## APPLE II PLUS OWNERS

Owners of Apple II PLUS<sup>TM</sup> computers can follow the same procedure with an INTEGER ROM card in slot 4.

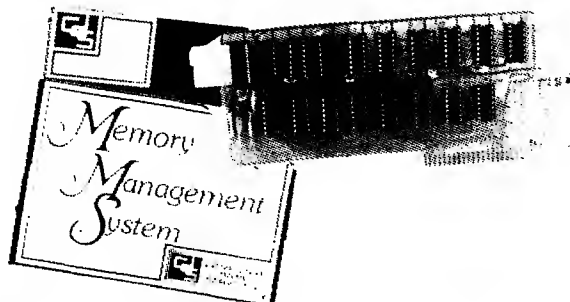
The final configuration of your Apple will be the **same** as above.

## SINGLE LANGUAGE ALSO

If you don't need dual language capabilities (PLUS owners who only program in APPLESOFT, for example), then MMS will still relocate DOS on the 16K RAM card in slot 0. A full 48K will still be available to the programmer.

## WHAT IS REQUIRED

- \* 48K Apple II or Apple II PLUS
- \* 1 or more disk drives.
- \* 1 or 2 16K RAM EXPANSION BOARDS or APPLESOFT or INTEGER ROM CARD
- \* MEMORY MANAGEMENT SYSTEM by C.D.S.



## 16K EXPANSION BOARDS

Currently there are three 16K RAM boards available for the Apple computer.

Apple Language Card <sup>TM</sup>	(retail \$495.00)
MICROSOFT RAMCard <sup>TM</sup>	(retail \$195.00)
ANDROMEDA BOARD <sup>TM</sup>	(retail \$195.00)

ALL of these boards will work with MMS. However, since we market the ANDROMEDA 16K RAM EXPANSION BOARD, we are able to make the following offer:

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ANDROMEDA 16K RAM BOARD plus MMS diskette .....	\$215.00
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## A FEW PROGRAMMER NOTES

DOS is somewhat altered with MMS. The command INIT is disabled, so you should INIT all your diskettes prior to starting up with MMS. In addition, MAXFILES automatically defaults to 2 but can be changed if desired.

The MMS program uses page 3 (\$300.-\$3FF) for interfacing and it is not available for programmer use.

Regardless of your Apple's configuration, approximately 2K of memory is devoted to the internal operating system (monitor).

Special configurations of MMS are available upon request.

## HOW TO ORDER

MMS and the ANDROMEDA 16K RAM EXPANSION BOARD are available through your local computer store.

Or you can order **direct** by calling **COMPUTER DATA SERVICES** at (516) 360-0988. VISA, Master Card, and COD accepted. Credit card and check orders are shipped postage - paid. Shipping charges are:

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This Apple Demo creates a Hi-Res picture in Pascal, then saves it to disk. Then it is reloaded and displayed.

Anon., "IAC Application Note: Pascal Utility Program," pg. 8-9.

Program in Apple Pascal which reads from REMIN and writes to disk.

Anon., "IAC Application Note: Linefeed-Pascal Utility." Program to set or defeat Linefeeds, Apple Pascal.

Yee, David R., "Catalog Organizer," pg. 12-13.

Organize the catalog on Apple diskettes in alphabetical order.

Anon., "IAC Application Note: COMCARD-Pascal Utility," pg. 13-14.

Program in Apple Pascal to set up COMCARD parameters.

Yee, David R., "Mass Lock and Unlock," pg. 14.

An Applesoft to lock or unlock all the files on an Apple diskette at once.

Anon., "IAC Application Note: Program Foreign—Pascal Utility," pg. 15-18.

A major utility in Apple Pascal.

#### 915. 73 Magazine No. 242 (November, 1980)

Erdei, Steven C., "PL Tones from a KIM-1," pg. 112.

A KIM program that will generate a square wave tone anywhere in the range of 191 Hz to 66 Hz.

#### 916. Personal Computing 4, No. 11 (November, 1980)

Gillie, Michael D., "Printing Pictures from Your PET," pg. 52-54.

A PET program to gather the characters off of the PET screen and print them on the Commodore 2022 printer.

Lubar, David, "Microbiocide," pg. 79-80.

A discussion and hints for debugging programs on the Apple.

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Cesa, Louis, "Kinetic String Art for the Apple," pg. 62-63.

High resolution program for the Apple.

Sokol, Dan, "Three-Dimensional Graphics for the Apple II," pg. 148-154.

A novel program for Hi-Res Apple graphics.

Ramsdell, Robert E., "The Power of VisiCalc," pg. 190-192.

All about this interesting piece of business related software for the Apple.

#### 918. The Paper (Summer, 1980)

Haluza, Doug, "Cross Referenced Memory Map," pg. 4-6.

Memory map comparing locations on old and new PET ROMs.

Haluza, Doug, "Machine Language is Faster Than You Think," pg. 7.

Some examples for the PET.

Batcher, Bill, "The Evolution of a Puzzle," pg. 8-9.

A tutorial on handling strings on the PET.

Haluza, Doug, "Machine Language is Still Faster Than You Think," pg. 10-11.

A machine language sort with assembly language routine and a BASIC Demo for the PET.

Comito, JoAnn, "Stringing Your PET Along," pg. 12-15. Two related discussions of Strings with examples, including an expression analyzing string routine for the PET.

Fowler, James, "Assembly Language Programming: Part 1," pg. 16-17.

Part One of a series for the PET programmer.

Eisner, Gerry, "POKE a Border," pg. 17-18.

A utility for the PET, with examples.

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A utility for the PET.

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A tutorial on the PET's If-Then statement.

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Discussion of a number of details in PET BASIC.

Haluza, Doug, "Trouble-Shooting Your PET," pg. 26-28.

Some hints for reviving the dead PET.

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A tutorial on the use of the PET timing routine.

Comito, JoAnn, "Writing That Good Educational Program," pg. 30-33.

Two related articles on writing PET educational programs, with examples.

Bressler, Ralph, "PET Files," pg. 36-39.

A tutorial for PET Tape Files and a sample listing.

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All about the PET merge system.

Haluza, Doug, "An 80 by 50 Plotting Routine," pg. 42.

A PET listing for a plotting program.

Haluza, Doug, "PEEKing at BASIC," pg. 42-43.

A utility for PET.

Bressler, Ralph, "PET's Round Off Problems," pg. 43, 48.

#### 919. The Harvest 2, No. 3 (November, 1980)

Lyle, Guy A., "Float, Float, Float Your Point," pg. 1-5.

A tutorial on floating point representation on the Apple.

#### 920. Nibble No. 6 (November, 1980)

Connolly, Rick, "P.I.P. II: PIP Goes Disco," pg. 9-13.

A disk version of P.I.P. (Personal Inventory Program).

Litwin, Larry M., "A Simplified Way For a Tiger to Eat Apple Pie," pg. 21-22.

An Apple graphics Pascal program outputting to a Paper Tiger.

Mottola, R.M., "Amper-Interpreter," pg. 27-44.

Add "Print-Using" to your Apple's Instruction Set.

Harvey, Mike, "Blocking Very Large Files," pg. 45-47.

A technique for file management on the Apple.

Figuera, John, "Roundoff!," pg. 47.

Round off decimal values to a manageable format on the Apple.

Reynolds, William III, "Finding the Slot Number," pg. 48.

How to write programs addressing interface cards on the Apple.

Harrell, Keith, "Pascal Pointers and Principles," pg. 51-52.

A new column for Apple pascal programmers.



Rogan, J.A., "Four-In-A-Row," pg. 55.

A Lo-Res graphics game for the Apple.

Crossman, Craig, "An Assembly Language Tutorial," pg. 57.

This installment discusses the Screen Clear, RDKEY, and COUT in the Apple monitor.

Crossman, Craig, "Apple Tricks," pg. 59.

More Apple tricks including Fast DOS, Special Characters, and Unstable programs.

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Staff, "Fontedit," pg. 2-22.

A program to allow the Atari user to design character sets. Listing and complete information on the design and use of the program.

Staff, "Knotwork," pg. 22-36.

How to design a type of manuscript illumination in Atari programs. Listing and complete description.

Staff, "Hacker's Delight," pg. 36-46.

A compendium of useful memory locations for the Atari operating system.

Staff, "Loadfont," pg. 46-49.

A utility for use in writing programs on the Atari using private fonts.

#### 922. KB Microcomputing No. 47 (November, 1980)

Smith, Wayne D., "A Mini Logic Monitor and Single-Cycler for Hardware Debugging," pg. 59-66.

Hardware for your KIM-1.

Bugg, Michael L., "Tinkering with Tiny BASIC," pg. 88-96.

Add four new and useful commands to Tiny BASIC as implemented on the KIM-1.

Brock, Thomas D., "Hard Copy for Apple Graphics," pg. 100-102.

Software for printing the high-resolution screen using a Diablo printer.

Bruely, Alfred J., "Microcomputer Hardware for the Handicapped," pg. 173-174.

Single-key data entry for the PET.

#### 923. Recreational Computing 9, No. 3, Issue 48 (November/December, 1980)

Berggren, Stephen R., "DOZO in Pascal," pg. 32-36.

A Japanese DOZO game in Apple Pascal.

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Guerard, Michael P., "Another Slice of Pi," pg. 8.

A way around a minor bug in arcsine and arccosine functions in Applesoft and TRS-80 Level II BASIC.

Piele, Donald T., "How To Solve It—With the Computer," pg. 66-71.

Part 3 of this series discusses Apple graphics and FOR—NEXT statements.

Kielian, Greg, "Bombproof Data Entry," pg. 102-104.

Unusual data entry methods for the Apple.

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Translation for the Apple from a program written for a DEC PDP/11.

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PET music programs, hardware for blinking lights with the PET, and a video car driver game.

Blank, George, "Outpost: Atari," pg. 170-171.

Atari Pascal is on the way, Atari Visicalc is available, also description of the PIA, ANTIC, CTIA, and POKEY chips for Atari.

Carpenter, Chuck, "Apple-Cart," pg. 172-180.

Absolute indexing, Indirect indexing, Interrupts, etc. on the Apple.

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Williams, Richard, "How to Use the Hooks," pg. 7-9.

Hooks allow the user to break the normal flow of control and redirect the Apple to his own routine.

Hart, John E., "An Ultra-Fast Tape Storage System," pg. 11-14.

A simple hardware modification to the OSI Superboard and a good home tape recorder yield data-transfer rates of up to 9600 baud.

Sebra, Randy, "SYM-Bell," pg. 17-24.

Use your SYM as a telephone memory dialer.

Morse, P. Kenneth, "Self-Modifying PET Programs," pg. 29-31.

A tutorial on writing a self-modifying program.

Needleman, Ted, "General Ledger for the Apple II," pg. 33-34.

The SBCS general ledger is a major business program for the Apple II. A review.

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How the 6502 microprocessor is able to perform tasks in medical education nearly as well as large computer systems.

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Correct the BASIC error message output, put out messages of your own, etc.

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Discussion and listing of an Atari color graphics program.

Bridge, Theodore E., "John Conway's Game of Life Using Display Devices with Automatic Scrolling," pg. 53-58.

A KIM listing easily adapted to other 6502-based micros.

Peterson, Craig, "Step and Trace for the Apple II Plus," pg. 61-63.

Restore the Step and Trace functions of the original Apple II.

Flynn, Christopher J., "AIM 65 File Operations: Writing Text Files with BASIC," pg. 65-70.

The value of AIM BASIC is greatly enhanced with this technique of writing text files.

Rowe, Mike (Staff), "The MICRO Software Catalog: XXVI," pg. 72.

Review of five new 6502 software items.

Dial, William R., "6502 Bibliography: Part XXVI," pg. 76-77.

Some fifty-five new references to the 6502 literature.

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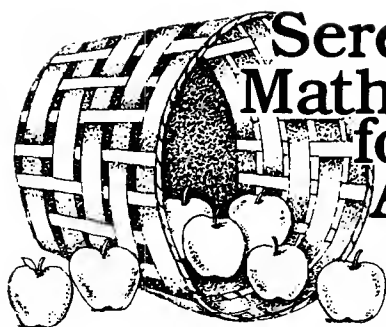
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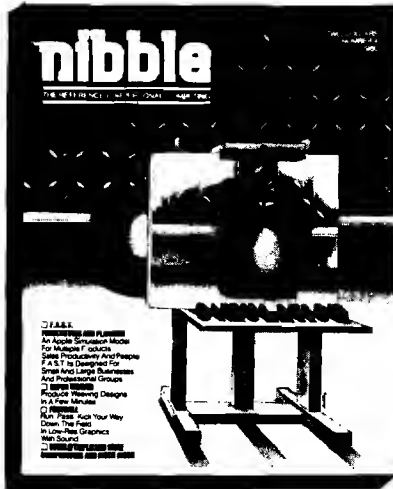
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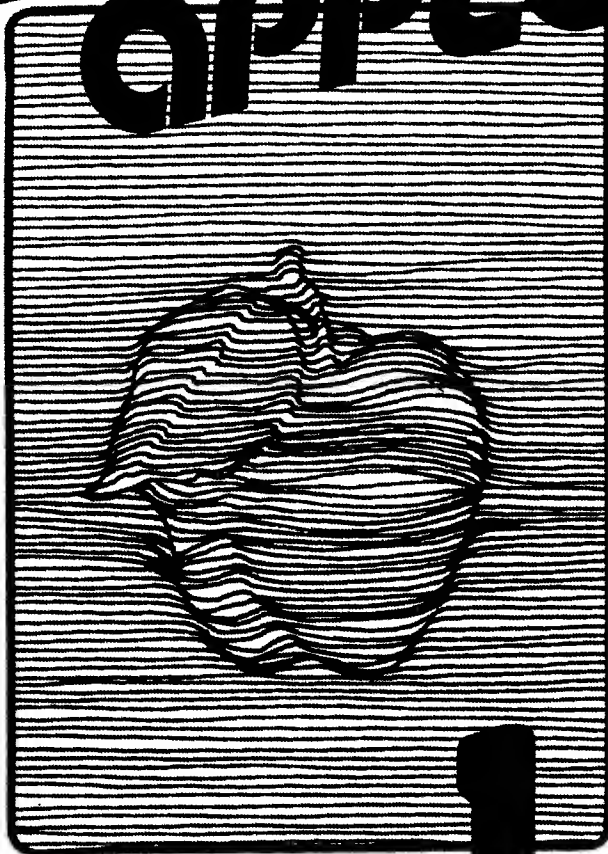
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